A STUDY OF BILLBOARDS AND JUNKYARDS AS RELATED TO SOME ASPECTS OF THE AESTHETICS OF THE HIGHWAY ENVIRONMENT

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BY

C. I. MacGILLIVARY

JHRP

JOINT HIGHWAY RESEARCH PROJECT

PURDUE UNIVERSITY AND

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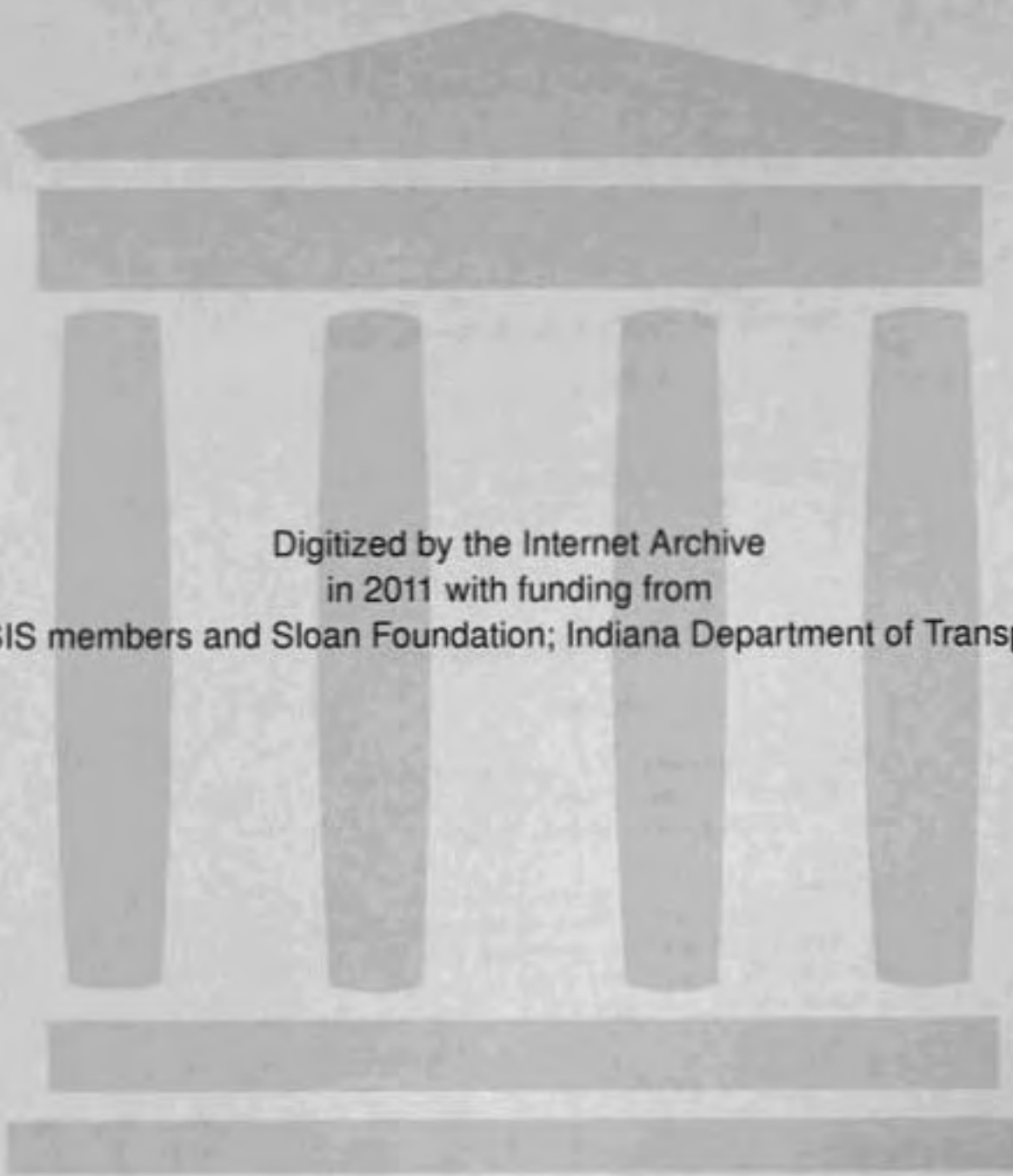

FINAL SUMMARY REPORT

A STUDY OF BILLBOARDS AND JUNKYARDS AS RELATED TO SOME ASPECTS OF THE AESTHETICS OF THE HIGHWAY ENVIRONMENT

by

Colin Ian MacGillivray
Graduate Assistant in Research

Joint Highway Research Project
Project No: C-36-48D
File No: 9-5-4

Prepared as Part of an Investigation

Conducted by

Joint Highway Research Project
Engineering Experiment Station
Purdue University

In cooperation with the

Indiana State Highway Commission

and the

U.S. Department of Transportation
Federal Highway Administration
Bureau of Public Roads

Purdue University
Lafayette, Indiana
June 17, 1969

I think that I shall never see
A billboard as lovely as a tree.
And unless the billboards fall,
I'll never see a tree at all.

Ogden Nash

The Highway Beautification Act of 1965, which established a program for the regulation of both junkyards and billboards along the Interstate and Federal-Aid Primary Highway Systems, has been the cause and subject of great debate. Proponents of the Act claim many benefits while detractors cite several possible negative impacts due to various provisions of the Act.

The validity of an Act based primarily upon aesthetic considerations has been established in the Courts; that other benefits may occur is only complementary to the main purpose or motivation -- this is now an accepted principle. While several studies have identified various impacts such as that on the outdoor advertising industry, none appear to have evaluated the impact upon aesthetics or more particularly upon driving pleasure as experienced by the highway user.

This study sought to identify and quantify some aspects of and influences upon aesthetics and other related areas in terms of the impact on the highway user. Techniques from the field of Psychology, involving psychometric methods used to evaluate measures of "experimental aesthetics," were applied in an attempt to quantify some indicators of the aesthetics involved.

Two main factors were investigated, the effect of screening junkyards and the effect of various spacings of billboards. The 1966 Billboard and Junkyard Inventory of the Indiana State Highway Commission was used to identify situations that might serve the experimental purpose for either subject. A number of junkyards, each screened to a different degree, were selected and filmed in color. Likewise, a number of sections of roadside featuring a series of billboards spaced fairly evenly but with differing densities were selected and filmed.

These sections of film were assembled into two separate motion pictures, one of which showed a series of junkyards with a variety of degrees of screening; the other showed a series of roadside sections with billboards along the road, with different spacings of billboards in various sections. These two motion pictures were the basic source for data collection and further analysis.

Each film was shown to a number of individuals and groups throughout the State of Indiana. The individuals viewing the films were the source of the data used in the analysis in an attempt to evolve a relationship that would indicate a value for the relative aesthetics of the various film sections. This could then be related to the physical measurement of the junkyard screening or the average spacing of the billboards shown in the films. The various individuals were also asked to respond to a number of other questions at the same time.

The analysis of junkyard screening data led to the conclusion that the public would prefer to have junkyards screened. Figure 1 indicates the relative relationship found in this investigation. This figure indicates that junkyards when visible to any degree are objectionable and that the less they are screened the more objectionable they are; zero on the derived scale represents indifference and negative values may be equated with objectionable.

The analysis of billboard spacing indicated that a decrease in the relative aesthetic value was related to an increase in the number of billboards per mile. It also indicated that a certain maximum frequency is all that is tolerable to the public; this maximum was found to vary slightly with various other factors such as age and number of miles driven per year on the part of the individuals in the investigation. Figure 2 indicates the relative relationship found from all participants in this investigation. In this figure, zero on the derived scale represents indifference while positive may be equated with satisfactory or not objectionable and negative with unsatisfactory or objectionable.

The individuals participating in this investigation indicated in the questionnaire section of the study that billboards were of little importance or aid as sources of information regarding either locating a place to obtain accommodations or meals. However, they indicated that billboards along the roadside are not necessarily very objectionable, particularly when compared with the highly objectionable factors of confusing or inadquate signs and inept or

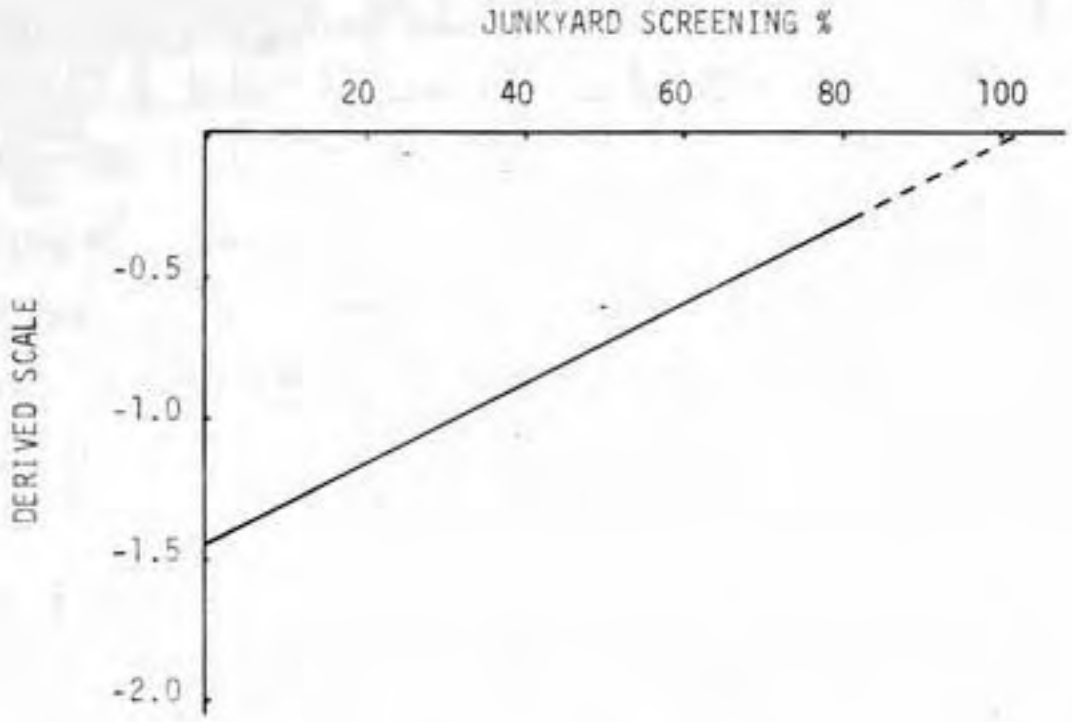

FIGURE 1. SCALE VALUES FOR JUNKYARD SCREENING, ALL PARTICIPANTS.

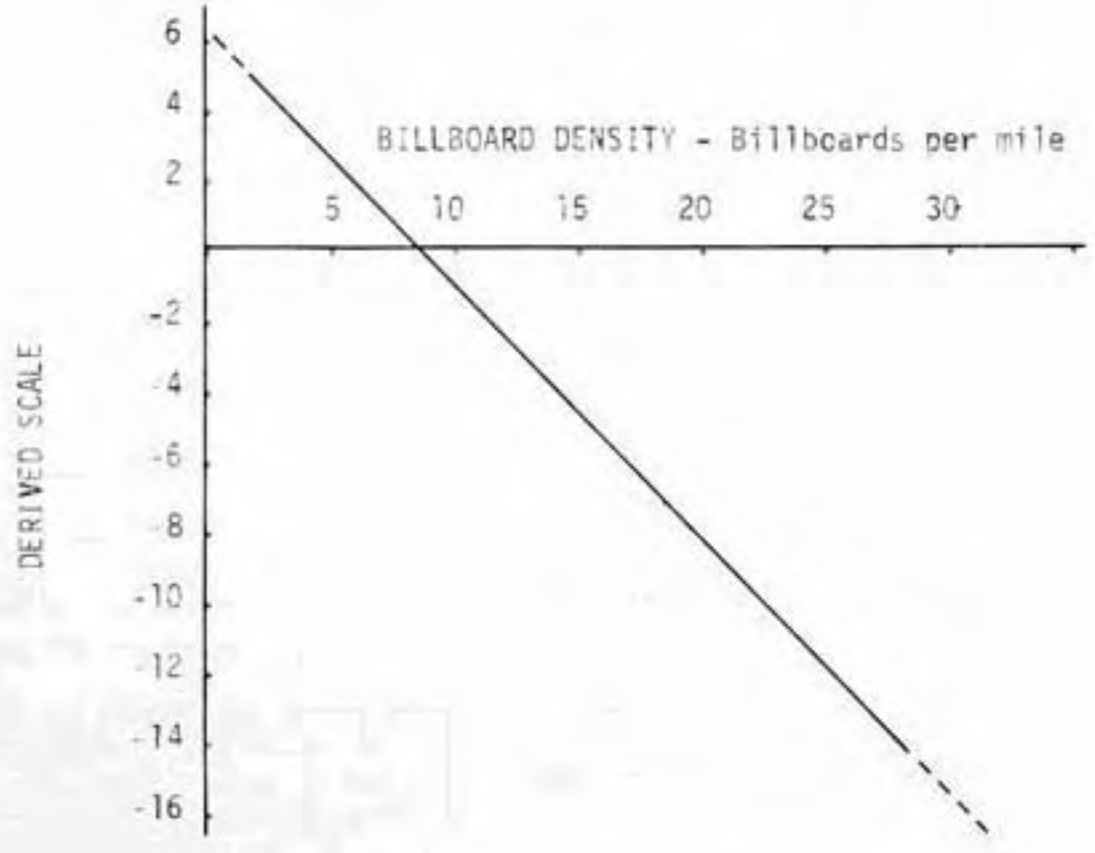

FIGURE 2. SCALE VALUES FOR BILLBOARD DENSITY, ALL PARTICIPANTS.

incompetent drivers. They also expressed a strong preference, among official signs directing motorists to services, for those signs with brand name information and with a designation of the particular type of service.

They indicated a favorable attitude towards some form of control of junkyards, such as the screening of them. They also indicated a desire for restrooms, drinking water, telephones, night lighting, picnic tables and information aids at roadside rest areas but little desire for overnight camping space.

This investigation also is an example of the application in Civil Engineering of several techniques from the field of Psychology to problems dealing with intangibles or social factors. Many such techniques undoubtedly exist in other disciplines that are applicable in the study of many problems that have plagued or perplexed engineers for years, particularly in areas relating to social values and aesthetics.

This Final Summary Report is a brief statement of the purpose, procedures and findings of a research project reported in detail in the following Research Reports:

1. Final Report "A Study of Billboards and Junkyards as Related to Some Aspects of the Aesthetics of the Highway Environment" by Colin Lan MacGillivray, Joint Highway Research Project, Purdue University, Report No. 18, June 1969, 199 pp.

2. Technical Paper "An Evaluation of the Aesthetics of Junkyard Screening and Billboard Densities", by C. I. MacGillivray and H. L. Michael, Joint Highway Research Project, Purdue University, Report No. 26, October 1968, 22 pp.

Final Report

A STUDY OF BILLBOARDS AND JUNKYARDS AS RELATED TO SOME ASPECTS OF THE AESTHETICS OF THE HIGHWAY ENVIRONMENT

TO: J. F. McLaughlin, Director
Joint Highway Research Project

June 17, 1969

File No: 9-5-4

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

Project No: C-36-48D

The Final Report on the HPR Part II Research Project titled "Effect of Junkyard Screening and Billboard Density" is attached. The title of this report is "A Study of Billboards and Junkyards as Related to Some Aspects of the Aesthetics of the Highway Environment". It has been authored by Mr. C. I. MacGillivray under the guidance of Professor H. L. Michael, both members of the Project staff.

The procedures used in evaluating public reaction to relative amounts of junkyard screening and of various billboard densities were unique to engineering studies. The results provide information for a tolerable density of billboards and the benefits of junkyard screening.

Several films of junkyards with different degrees of actual screening and of a range of billboard densities were made to obtain public reaction. Copies of these films are not included with the Final Report but they can be obtained and provided to the ISEC and the BPR if desired. Copies can also be provided others as desired for the cost of duplication.

A brief Summary Final Report has also been prepared and will be submitted. This report is submitted for acceptance as completion of the objectives of Phase I of the research Project. Copies of the report will also be submitted to the ISEC and BPR for their comment and acceptance. An originally proposed Phase II of this Project is not now planned as the activity to date of the ISEC in junkyard screening and billboard control do not warrant an evaluation of their effectiveness, the original objective of the research of Phase II. As a result this Report will terminate this research.

Sincerely,

Harold L. Michael

Harold L. Michael
Associate Director

HLM/rg

cc: F. L. Ashbaucher
W. L. Dolch
W. H. Goetz
W. L. Grecco
G. K. Hallock
M. E. Harr
R. H. Harrell
J. A. Havers
V. E. Harvey
G. A. Leonards
F. B. Mendenhall
R. D. Miles
C. F. Scholer
M. B. Scott
W. T. Spencer
H. R. J. Walsh
K. B. Woods
E. J. Yoder

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The author wishes to express his appreciation to Professor H. L. Michael, Associate Director, Joint Highway Research Project, for his guidance and recommendations throughout the course of this investigation and for his review of the manuscript; also to Professor W. L. Grecco and Professor D. R. Brown for their suggestions, assistance, recommendations and review of the manuscript during the progress of this project.

Acknowledgment is also made to Mr. J. Senn, Purdue Audio-Visual Center, for assistance with the photography and preparation of the films and to Mr. M. Overway and Mr. D. K. French for assistance in data collection.

The author wishes to extend his thanks and appreciation to the various groups and individuals who assisted and took part in this investigation as subjects.

The author wishes to gratefully acknowledge the sponsorship of the Joint Highway Research Project and thank the Indiana State Highway Commission for its financial support and assistance.

The author is particularly grateful to his wife for her patience and understanding and editorial assistance in the preparation of this report.

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ABSTRACT

MacGillivray, Colin Ian. MSCE, Purdue University, August, 1969. A Study of Billboards and Junkyards as Related to Some Aspects of the Aesthetics of the Highway Environment. Major Professor: Harold L. Michael.

The purpose of this investigation was to examine possible impacts upon driving pleasure as experienced by motorists and others due to billboards and junkyard screening, in order to evaluate certain aspects of the Highway Beautification Act of 1965.

Two color motion picture films were prepared, one depicting varying occurances or densities of billboards along the highway, the other depicting varying degrees of junkyard screening. These were shown to audiences throughout the State of Indiana.

The viewers of each of these films were asked to indicate their reactions to the various sections of the films. These reactions were analyzed using psychometric techniques from the field of Psychology in order to establish psychological scales which were then related to physical scales by regression analysis. The physical scales were measurements of junkyard screening (percentage) and billboard density (signs per mile).

This gave a measurement of attitudes, as related to the impact of junkyard screening and billboard density, on the aesthetics of the view from the road.

It was found that the participants disliked any obvious presence of junkyards and that increases in screening led to less objectionable

situations. It was also found that billboards were considered unattractive, that increasing billboard density led to decreasing pleasure and that approximately eight (8) billboards per mile was a maximum acceptable or tolerable frequency. The conclusion reached was that a few billboards would be unobjectionable to most people but a limit of a few per mile would be preferable.

INTRODUCTION

I think that I shall never see
A billboard as lovely as a tree.
And unless the billboards fall,
I'll never see a tree at all.

Ogden Nash.

Historical Background

"More than any other country, ours is an automobile society." For most Americans, the automobile is a principal instrument of transportation, work, daily activity, vacation, and pleasure. By making our roads highways to the enjoyment of nature and beauty, we can greatly enrich the life of nearly all our people in city and countryside alike.

"Our task is twofold. First, to insure that roads themselves are not destructive of nature and beauty. Second, to make our roads ways to recreation and beauty."

President Johnson spoke thusly in his "Message on Natural Beauty" to the Congress of the United States (52)*

The American Public thinks of its highway network as a necessary and useful convenience, but rarely gives any thought to roadside environment even though driving for pleasure is the Nation's most important outdoor recreation activity. At least one-third of all U. S. motor travel is for social, recreational or vacation purposes; this accounts for 42 percent of all outdoor recreation (52). Obviously then, Americans want to drive for pleasure.

Today they also are concerned about the roadside and what they

* Numbers in parentheses refer to the numbered Bibliography.

see developing. The culmination of this aroused and concerned interest, on the part of both Congress and the Public, is evident in the passage of the Highway Beautification Act of 1965. This is an outgrowth of the earlier Federal-Aid Highway Act of 1958 and a history of strong critical review. The necessity of protecting and enhancing the natural beauty that exists along our Nation's highways has long been recognized by conservation and civic groups and some highway administrators.

In 1932 a joint committee of the Highway Research Board (HRB) and the American Association of State Highway Officials stated: "Roadside development must conserve, enhance, and effectively display the natural beauty of the landscape through which the highway passes ....."(46). In 1933 the HRB became interested in the increasing menace to the safety, comfort and enjoyment of highway travellers due to the presence of outdoor advertising along the highway (14). This resulted in the creation of a Committee on Roadside Development.

The American Municipal Association became concerned enough over the increasing problem in 1934 to issue a report giving a recommended policy for automobile junkyards and roadside protection (2). Other groups were following similar interests as illustrated by the activity of the Roadside Council of Ohio which, in a 1935 survey, listed 5400 objectionable billboards in 20 Ohio Counties (22). In 1935 they also sponsored what must rank as one of the first state-wide billboard control laws. It was turned down after a heated and protracted debate by the legislature; thus began a continuous campaign which, in 1938-39, saw sponsorship of an effort to pass a modern control law which in many ways was the forerunner to today's Federal Standards.

In 1947 Maryland attempted a program of voluntary cooperation in establishing protected areas or "scenic preserves" (6). Two such areas were established in 1947 -- The Gambrill Scenic Area and The South Mountain Scenic Area; no information seems available on the success of this project but the results appear to have been poor! The AASHO Convention of 1947 was told of New York's approach in handling this roadside problem of billboards; this included the use of minimum set-back restrictions (56).

Groups other than those directly involved with or interested in highways have also taken official interest in this area. In 1950 the Garden Club of America and the American Museum of Natural History issued a joint plea in their report "Conservation Please" (10).

The National Roadside Council, in 1950, reviewed the question of voluntary programs in checking roadside blight (27), while in 1951 the American Automobile Association studied the problem of roadside protection and suggested possible approaches to the problem including the purchase of additional right-of-way or scenic easements. In a 1952 survey (using a limited sample from 20 States) it also found over 90 percent of the motorists wanted billboards restricted on rural roads, 66 percent wanted "sharp restrictions" with, however, provision for advertising signs in certain instances (21).

The Western Association of State Highway Officials heard, at the annual conference in 1952, proposals for the use of easements for roadside development control as an aid in highway beautification (55). Also in 1952, the State of New Jersey reported its policies and standards for the Blue Star Memorial Highway including recommendations

against junkyards adjacent to the highway and for control of billboards (14). In 1953 Rutgers University (31) and the American Society of Planning Officials (4) both presented recommendations for zoning to achieve roadside control.

A noted highway official, Fred Burggraf, stated, in 1954, "A very large proportion of the use of our highways is for the purpose of recreation and the primary reason for pleasure-touring is enjoyment of scenery," thus noting as few highway men had previously that recreation was a vital function fulfilled by highways (9). Reflecting this increased awareness was E. R. Hailer, Jr., when he spoke, in 1958, of aesthetic values in highway design (17), but by this time many critics had begun to dispare as did Carl Goldschmidt in his commentary "Windshield Vistas - Who Cares?" (15).

This activity and interest was recognized by the U. S. Congress in the Federal-Aid Highway Act of 1958 which included a provision for a billboard control program. This was for a one-half (1/2) percent bonus above normal Federal highway aid to those States that would enter into a voluntary agreement to control billboards along the Interstate System.

This provision, if anything, stirred more commentary on the many aspects of highway beautification and also prompted the first real expression of adverse opinion to many of the previously promoted ideas. The controversy has even produced its own version of best sellers in Peter Blake's "God's Own Junkyard" (8), and Donald Appleyard, Kevin Lynch and John Meyer's "The View from the Road" (5). However, the most articulate expression of opinion, if not the most widely known one, is found in Christopher Tunnard and Boris Pushkarev's "Man Made America: Chaos or Control" (41), which seems to have served as the inspiration

for others and in which they said:

> "It should be quite obvious, unless the freeway passes through a densely wooded area, the traveler can see a considerable distance beyond the right-of-way, where his eye can be hurt by all kinds of visual nuisances outside the highway property line.
>
> "By far the greatest eyesores are, of course, billboards and other advertising signs ....."

W. Brewster Snow (36) spoke of the pleasure to be gained from an unobstructed view and other earlier reports had also discussed the benefits of reducing roadside blight to increase aesthetic enjoyment (4, 31). Sylvia Crowe pointed out the English practice whereby local authorities are given power to control billboards as a possible alternative for the American scene but even so had to admit: "Both brewers and petrol firms are guilty of inflicting blatant and incongruous signs on countryside and village" (12).

President Kennedy recognized the highway beautification problem in his special message to Congress, February 28, 1961:

> "The Interstate Highway System was intended, among other purposes, to enable more Americans to more easily see more of their country. The System was not intended to provide a large and unreimbursed measure of benefits to the billboard industry, whose structures tend to detract from both the beauty and the safety of the routes they line. Their messages are not, as so often claimed, primarily for the convenience of the motorist whose view they block. Some two-thirds of such advertising is for national products, and is dominated by a handful of large advertisers to whom the Interstate System has provided a great windfall" (7).

By 1964 it was realized that the voluntary provisions of the 1958 Act were not achieving the desired results. By the time this provision expired on June 30, 1965, only 25 States had entered into agreements (46) and only 8 had become eligible for payments (57). The Recreation

Advisory Council recommended a National Program in 1964 taking into consideration much of what had been written and said previously (32). This and other Cabinet level committee recommendations (52) led to the Highway Beautification Act of 1965. When President Johnson declared in his January 1965 State of the Union Message "A new and substantial effort must be made to landscape highways and provide places of relaxation wherever our roads run" (46) sufficient legislative support was gained to authorize a new program on the scale required. Realizing the shortcomings of previous programs, provisions of the 1965 Act were made mandatory with the possible penalty of loss of a portion of Federal highway aid to enforce the Act.

Current Outlooks

The new Act has caused an even more forceful and meaningful debate, and has caught the public interest much more than any previous activity in this field. Americans are now becoming aware of and many are becoming concerned about the view from the road -- in terms of what it is and what it might be? Also, many of the directly affected concerns, the outdoor advertising industry, users of outdoor advertising such as motels and restaurants, junkyard owners, etc. are now speaking up. Then too, many people are questioning the basic assumptions of necessity or usefulness of the controls, particularly in light of the costs of the program. Still others desire even further controls or are opposed to provisions that allow any junkyards or billboards to remain or provide compensation for any removed items.

As pointed out by the American Public Works Association in its testimony before the House Subcommittee on Roads during hearings on the

Bill in 1965:

> "'Beauty,' it has been said, 'is in the eye of the beholder.' There can be no precise set of criteria to describe what is aesthetically attractive and what is not. We will always have a certain amount of controversy, particularly in urban areas, regarding the aesthetic appeal of specific projects. One group will say that a facility is beautiful; another will insist that it is not. It is, to some degree at least, a matter of taste" (49).

The 1965 Act has been the subject of a great deal of editorial opinion for and against all or part of the Act. Editors have expressed themselves in cartoons (50, 61) and text (25, 26). The outdoor advertising industry has even used its media to respond editorially (59, 62). Technical and trade journals have all taken positions on various issues as illustrated by one editorial in a trade journal, "Compressed Air":

> "The traveling public has indicated quite strongly that it is interested in aesthetics, as well as safety and a smooth, relaxed ride, on the highways for which it is paying" (63).

Much of this comment has been directed at the various States as they have considered and generally adopted matching legislation.

Additional Justifications

A short history of legal questions involved in the various aspects of the 1965 Act includes the first case involving the placing of a sign, 'Hoare v. The Metropolitan Board of Works' [LR. 9QB 296 (1874)] in 1874 (19). A slightly more recent case was an early Indiana decision in 1930, 'General Outdoor Advertising Co. v. Indianapolis' [202 Ind. 85, 172 N. E. 309 (1930)] in which the Court said:

> "Under a liberalized construction of the general welfare purposes of State and Federal Constitution there is a trend in the decisions (which we approve) to foster under the police power, an aesthetic and cultural side of municipal development -- to prevent a thing that offends the sense of sight in the same manner as a thing that offends the sense of hearing and smelling" (63).

A more recent case in which aesthetic purposes were held valid in justifying setback and screening regulations for junkyard control is cited by O'Reilly (28) [People v. Stover, 12 N. Y. 2d 462, 467, 191 N. E. 2d 272, 275 (1963)] in which the Court held:

> "Once it be conceded that aesthetics is a valid subject of legislative concern, the conclusion seems inescapable that reasonable legislation designed to promote that end is valid and permissible exercise of the police power."

Two recent cases in Kentucky include: 'Jasper v. Commonwealth' [375 S. W. 2d 709, 711 (Ky.)] in which the Court said:

> "We have recently considered that question and have accepted the aesthetic consideration as justifying the exercise of police power. "..... the obvious purpose of this Act is to enhance the scenic beauty of our roadways by prohibiting the maintenance of unsightly vehicle graveyards within the view of travel thereon. While there may be a public safety interest promoted, the principle objective is based upon aesthetic considerations. Though it has been held that such considerations are not sufficient to warrent the invocation of police power, in our opinion the public welfare is not so limited."

'Churchill and Tait v. Rafferty' [31 P. I. 580.609, appeal dismissed 284 U. S. 591] in which the Court stated:

> "We can see that the regulation of billboards and their restriction is not so much a regulation of private property as it is a regulation of the uses of the streets and other public thoroughfares"(19).

John G. Duba suggests that changes in the value of land along a highway may be related to and justify regulation (13) but other researchers have not been able to clearly determine this point.

One other area has often been suggested as justifying regulation of billboards, traffic safety. It is a fact of advertising that billboards are placed where traffic is greatest (40), in fact traffic volumes have a great effect on the value of advertising space and the

price charged by the outdoor advertising industry. This is some recognition of the remarks of President Kennedy. Then too, the prime objective of the designer of such advertising is to gain the attention of the motorist. Several suggestions and comments to the designer and student of advertising include (34):

> "Copy requirements of outdoor advertising require that the message be brief so motorists can get its meaning in a very short space of time."
>
> "Brevity is a necessity in copy, and pictures are highly important in gaining attention."
>
> "The flashing electric sign is considered most effective."
>
> "The potential value of poster boards is measured in terms of the number of persons passing during a given interval of time. To provide an authentic measure of such traffic, the Traffic Audit Bureau was established for outdoor advertising."
>
> "The principle item of cost is the rental of space. (Meaning the display space on an erected board) Such costs vary a great deal according to the volume and character of traffic past the board."
>
> "National advertisers account for two-thirds of total outdoor advertising expenditures."
>
> "Advantages of outdoor advertising:
>
> 4. Allows greatests possible use of two powerful advertising factors: color and huge size.
> 7. Every position is a preferred position. Advertiser is forced to recognize importance of full circulation through advantageous placing.
> 9. Economy. Granting one 'circulation' as good as another, the poster at a quarter-a-thousand probably leads the field for cheapness.
> 11. Enforced simplicity. Must tell whole story in six seconds. Therefore, eliminates possibility of waste through complicated copy."

This list points out the advertiser's approach to billboards and traffic, he tries to gain and hold attention in competition with the driving task and its demands for safety.

Yet, Carl McMonagle in reporting on research into this very question in Michigan said (23,24):

> "It was recognized that in many of these cases, the indicated degree of association of a feature with accidents might be, in reality, a reflection of the degrees of association among the features themselves.
>
> "When partial correlation was applied to the features ..... the coefficient of ..... advertising signs went down to practically zero."

O. L. Kipp reported a high correlation between accident rates and sign frequency but his failure to account for other probable factors such as traffic volume invalidates his conclusions as reported (20).

Paul R. Staffeld identified some degree of association in a study but the conclusions are not well supported in light of the results of others.

A more recent study by Madigan - Hyland which showed a high degree of correlation was shown to be in error in its statistical analysis during Hearings before the House Subcommittee on Public Roads (49). The general conclusion that must be reached is stated by McMonagle during the same Hearings: "..... outdoor advertising signs had no relationship to accidents on any highway" (49).

Billboards and Junkyards in Indiana

The Indiana State Highway Commission, according to guidelines of the U. S. Bureau of Public Roads (47, 48) prepared an inventory of billboards and junkyards in the State (May, 1966). The scope of the problem is seen in this inventory which identified 410 junkyards and 41,923 billboards. These are viewed 227,000,000 times each day by automobile drivers in Indiana -- assuming each car passing each sign carries only

one person and that person notes the sign. The distribution of signs and junkyards throughout the State is indicated in a series of Figures and Tables in Appendix A, Figures A1, A2, A3 and A4 and Tables A1, A2, A3, A4, A5, A6, A7, A8 and A9. This inventory included only signs and junkyards along the Interstate System and Federal-Aid Primary Systems in Indiana -- a total of 401.5 miles of Interstate and 4746.6 miles of F. A. P. as of May, 1966 (summarized from the Inventory).

As may be seen from Table A1, the majority of signs are small, most having a surface area of less than 50 square feet.

Impacts of the 1965 Act

The Bureau of Public Roads has identified several areas of interest for study of possible impacts due to the 1965 Act, and has established a procedure for determining the estimated impacts and costs of a recommended program (44, 45, 48).

Areas of study identified include the outdoor advertising industry, users of outdoor advertising, motorists in need of services, junkyard operaters, etc. Impacts upon motorists were identified as including comfort and convenience, driving pleasure and information needs.

Several studies are under way or have been completed identifying impacts on the outdoor advertising industry and its users (11, 38, 44, 49, 50, 51). Others have examined factors affecting motorists needs and services (54) but few have examined the impact on driving pleasure or the aesthetics of the view from the road.

It is this area of aesthetics as related to some aspects of both junkyards and billboards that this project has endeavored to study. While this will by no means supply the complete answer to the many and

varied questions raised by the 1965 Act, it will aid in a better understanding of the questions of public taste and preference.

Prior to this project little, if any, work had been done on measuring and quantifying the public's attitude towards its environment particularly beyond the scope of laboratory experiments or simple opinion surveys. This particular project has concentrated upon only a very narrow segment of the environment -- basically it is an attempt to answer the question: Do billboards and/or junkyards, in any manner, influence an individual's aesthetic appreciation and enjoyment during the highway driving esperience? Similiar work has been done by Peterson (30) studying open space and neighborhoods and is presently underway at the University of Florida on "Wild Land Raodside Environments" and aesthetics (43).

Aesthetics and Highway Beautification

"The primary benefits, of control of junkyards and billboards, to the public in general accrue when and as they are drivers or passengers in motor vehicles. The benefits to the highway user cannot adequately be quantified because many of them are aesthetic and intangible. Nonetheless, the benefits are real and can be described in such general terms as pleasure, convenience, and safety" (U. S. Dept. of Commerce, ref. 44).

"When an automobile has outlived its usefulness as a transportation vehicle it becomes an aesthetic problem" (U. S. Bureau of Mines, ref. 42).

Some motorists and public officials report a liking for billboards while the case against them has been well traced previously. Thus, a variety of opinions, often conflicting, exist regarding highway beautification and more important regarding what the public wants done.

Attitudes, Opinions and Psychology

> "Of the various procedures used to identify community values, the attitude survey is one of the most frequently utilized. In practice, opinions are often measured, instead of attitudes. Opinions are simple views, judgements, or beliefs having to do with specific situations. By their nature they are inherently unstable and are open to influence and change by social pressure. The use of opinions as a tool, therefore, has little predictive value.
>
> "Attitudes, however, are considered more basic and complex than opinions; they relate to rather abstract elements such as time, convenience, aesthetics and education. ..... Hence, attitude assessment is a more reliable basis for prediction of terminal action than opinion study" (35).

This study seeks to identify those underlying attitudes towards both billboards and junkyards in terms of aesthetic appreciation or enjoyment. This type of study is similar to that quite familiar to the psychologist and generally termed 'experimental aesthetics'. The first researcher of note in this field was Fechner (16) who studied aesthetic perception.

By using techniques developed in this field and studying group psychophysics, the variation in response over individuals may be observed. Thus the attitudes of the public may be identified and possibly quantified. This would be a major step towards evaluating those impacts on motorists previously deemed unquantifiable and intangible.

STUDY OBJECTIVES AND DESIGN

One of the principal points brought forth in many of the discussions centering on the topic of the 1965 Act has been the agreement on the need to identify, measure and quantify the aesthetic impact of highway beautification -- particularly regulation of billboards and junkyards. The Bureau of Public Roads, in its Staff Report "Economic Impact of the Highway Beautification Act," (44) clearly identified motorists as one of the major groups affected by the provisions of the Act and pointed out that an evaluation of 'economic impact' means much more than just direct costs, rather it includes "an increase in driving pleasure" and requires an evaluation of attitudes and opinions. Also acknowledged were the general lack of historical data and experience by which any of the possible effects of the Act might be predicted; there is a great need for research which would be predictive in nature.

This evaluation of possible changes in driving pleasure due to improvement in the effective screening and/or reductions in apparent view of junkyards, and due to reductions in billboard occurance along the roadside (or possibly complete elimination of billboards) may only be inferred and possibly predicted from an experimental procedure that studies attitudes. The basic relationship, if such exists, between these events and attitudes relating to pleasure may allow predictions to be made about possible changes in pleasure caused by such a program

of roadside improvement.

Other impacts upon motorists are of importance in addition to changes in aesthetic appreciation, such as convenience due to changes in the provision of information concerning motorist services. Thus it is desirable to learn more about motorists' needs for services, habits and preferences related to such services, and possible effects due to the provisions of the 1965 Act.

The use of experimental aesthetics and many of the techniques developed in the area of psychological measurement allowed a study to be made of attitudes as related to billboards (in terms of occurance or density) and junkyards (in terms of screening or apparent view). Hopefully some relationship could be thus established between the physical measurement of screening or density and some psychometric scale of attitudes. Thus changes that might be expected in attitudes, and possibly driving pleasure, may be predicted from possible changes in screening or density. This type of relationship, if it exists, could be used in quantifying, to some extent, the aesthetic impact of the Act.

A study of the other factors mentioned -- habits, needs, preferences, etc. -- was done by relating various observations on the use of aids, importance of aids, reliance upon aids, and source of aids, to each other. This involved identifying the motorists' opinions on such subjects as preferences for types of services, sources of information, ect. Direct collection of such information from motorists is to be preferred as it is the only technique for identifying what is desired, as well as actually relied upon. This may or may not be the same as the actual use made of any existing facilities; however, the real importance is what the

motorist thinks he wants. Properly designed questionnaires, when correctly used and interpreted, aid in identifying such information. Extreme care is needed, however, to avoid biasing any result thus obtained!

Sampling the general population allows some possible inferences to be made regarding public opinion, but care needs to be taken to insure a cross section of the public is sampled. Identifying selected socio-economic variables aids in determining the nature of the sample population used and its relationship to the general population. Some of these variables may also be related to general expressions of attitudes and opinions.

In order to reach the public at large, various groups throughout the State of Indiana were contacted and requested to participate in an investigation -- the general subject of highway beautification, but not the real nature of the investigation, was indicated to each group. This procedure might be expected to generally lead to the use of groups, perhaps representing a minority attitude, more concerned and interested in the particular question of highway beautification. If, however, a substantial minority is adequately concerned about any particular outcome or program, then perhaps such a minority should be heard and heeded! As broughtout later, this did not prove to be the actual case, there appeared to be no predominance of persons keenly interested or concerned in the subject, but rather just average people who gave generally unprejudiced responses to each section of the investigation.

Possible relationships were studied -- between opinions on different questions, between opinions and socio-economic variables, and between aesthetically oriented responses and other sections of the study. Correlation analysis and trends proved to be suitable analysis techniques

and are suited to attitude and opinion studies of this nature.

The appearance and effect of driving past a series of billboards or a junkyard was simulated by using color motion pictures. In this manner every individual observing the film saw exactly the same subject and based his response upon the same source, subject or stimulus, plus his own experience and attitudes. This also lent itself to control and measurement of the physical variables of billboard occurance (density) or junkyard screening (percent), and thus some relationship to the attitudes reported could be studied. For this purpose two color motion pictures were prepared, one for each general area of study -- junkyards and billboards.

FILMING

Site Selection

Criteria were first established and evaluated that might be of use in choosing prospective sites for filming. Primary emphasis, in the case of the billboard film, was placed upon a regular or even spacing of signs for any given density of signs per mile. Billboards varying greatly in size or shape were to be avoided and the relationship of the billboards to the roadway was held relatively constant. Primary emphasis, for the junkyard film, was placed upon obtaining a uniform screening effect for any given percentage of screening; the sizes of, and length of exposure to, the junkyards were also held as constant as possible. The type of screening was held constant in that only screening by vegetation was used. In both cases an attempt was made to cover as completely as possible the entire physical scales of screening and density.

The inventory of junkyards and billboards along the Federal-Aid Interstate and Primary Highway Systems in Indiana, as prepared by the Indiana State Highway Commission in May, 1966, was used as a guide in the preliminary selection of sites for further field investigation. (See Appendix A for summaries of this inventory.)

During the field investigation each site visited was cataloged and estimates were made for the various factors that would be involved if the site was filmed. During the course of this investigation, 95 percent

of the junkyards in rural areas of the State of Indiana, as listed in the inventory, were inspected. Sites in urban areas were not inspected as they did not generally fall under the provisions of the 1965 Act.

From this initial field inspection a number of sites were selected for filming. After filming, the film was reviewed and a more exact determination made of either the percent screening of the junkyards or the density of billboards. It was found desirable to make this evaluation from the film, rather than directly in the field, as the single view on the screen was that for which these measurements were desired.

The determination of billboard density was made using a stop watch to time the spacing of the billboards in the film during projection on the film. This was what the participant would see and was the true measure of the relative spacing. As the vehicle speed during filming was approximately constant for each section of film, this procedure worked satisfactorly. It was necessary to make this evaluation in the laboratory in order to determine how well the density scale was covered by the film sections. This viewing also gave an idea as to the suitability of each film section during a period when it was still possible to substitute alternative sites, or re-film any site.

A first evaluation of the percent screening of the junkyards was made more directly in the field by actual measurements along the road frontage. Visibility of the site during the approach and along the flank of the site were also evaluated, with those sites which varied substantially in effective screening in either instance from that measured along the frontage being rejected from the final sample. A second evaluation was made in the laboratory using the films. Complete

coverage of the screening scale proved one of the most difficult tasks in the filming process due to the limited sample of junkyards from which to select.

Site Photography

Filming was done from the passenger seat of a moving automobile using a hand held camera. After initial experimentation, the most suitable technique was found to be the use of a hand held camera, stabilized by a gyroscope attached to the camera from beneath. The equipment used consisted of a 16 mm. electrically powered movie camera with a 400 foot magazine supply of film. After trying several lens types, a F 2.8 - 25 mm. focal length lens was chosen as giving the best field of view. An electrically driven gyroscope, with its principal axis parallel to the axis of the lens, aided in damping vibrations and in smoothing panning. Filming was done at 16 frames per second and exposure was determined by using a light meter. Kodac ECO film was used, and prints were made from this negative for projection purposes. A fairly constant angle for the view was used, as measured from the highway center line.

Film Editing

The sorting and editing work was done in stages. First the film was organized into sections and viewed to evaluate its technical quality. Next, for the billboard film, a determination of the apparent density was made; for the junkyard film, the general suitability of the view was evaluated.

Individual film sections were desired that were of approximately the same length -- in each case about 30 seconds. These 30 second

sections of film were chosen and spliced together to form the final film. Indexing titles, to key the film to the questionnaire used by the viewer participants, were also spliced in at this time.

From this point each 30 second film section may be thought of as a stimulus and is so referred to in the remainder of the discussion.

The theory behind the analysis techniques required a particular arrangement for the presentation of the stimuli; this arrangement is explained in more detail in later sections of this report. However, the arrangement called for each stimulus to be presented separately, followed by a slight pause or blank section of film in the case of the billboard film; and for the stimuli to be grouped in pairs for the junkyard film (one stimulus following directly after the first with only an identifying index preceeding it) with each pair separated by a pause or blank section of film. After splicing the stimuli (film sections) in the proper order, the complete film was ready for viewing by the participants.

These steps and processes led to the eventual selection of five film sections used for stimuli in the junkyard film, from among 15 actually filmed; and to the selection of 12 film sections used for stimuli in the billboard film, from among 30 actually filmed.

FILM PRESENTATIONS

The Participants (Subjects)

The evaluation of the two films, and thus the scaling of the two categories of stimuli, required a fairly large number of participants -- commonly referred to as subjects. It is from the analysis of judgements by the subjects that the scale positions for the stimuli were determined. For this reason, explained in more detail later in this discussion, it was necessary to include a large number of subjects in the investigation particularly as it was necessary to show only one or the other of the two films to each group of subjects. As it was also desirable to infer, from the results of the investigation, the opinion of the general public, a serious attempt was made to involve a cross section of the population of the State. As may be seen from the data summaries presented later, this objective was not completely achieved but was substantially met. Groups were contacted with an explanation of the general intent of the project and with a request to aid by taking part. The varying composition of the groups contacted may be seen in this partial list of types of organizations contacted: labor unions; parent-teacher associations (both urban and rural); church groups; civic promotion groups; Chambers of Commerce; civil rights groups; women's professional groups; garden clubs; ladies aid and auxiliary groups; Lions, Elks, Eagles, Moose, Rotary and Kiwanis Clubs; men's professional groups; Purdue University

conference and extension groups; farmer's groups; student groups; etc. In addition to this cross section, deliberate attempts were made to include both urban and rural groups, to acheive a geographic distribution throughout the State (eg. South Bend, Pine Village, Lafayette, Indianapolis, Columbus, Terre Haute, and Jeffersonville are all represented in the study), to achieve an economic, cultural, educational and age balance.

In all, with the aid of local Chambers of Commerce around the State who provided lists of many organizations in their communities, more than 400 groups throughout the State of Indiana were contacted. From this total only 31 replies were received including several negative ones and ones from groups who's schedule of available time precluded their inclusion. Meetings with participating groups ranged from breakfast at 7:00 AM to late evening gatherings at 11:00 PM; the size of the 18 participating groups ranged from 6 to 55 persons. In all, 110 persons viewed the junkyard film and 210 persons viewed the billboard film.

Group Presentations

In making a presentation to a participating group an attempt was made to introduce the study to the group without passing any information that might prejudice any response to the various parts of the study. A sample introduction was prepared, see Appendix B, for use as a standard guide -- this eliminated a possible source or cause of variance between participating groups. After an introduction to the project and a description of the task each participant would be asked to undertake, the introductory portion of the film was shown to the group in order to better illustrate the task associated with the film. This helped

eliminate several sources of possible variance and/or error due to confusion. It also established the range of the stimuli on the physical scale -- thus 'anchoring' the scale, and reducing the effect of 'learning' in the judgement process. At this point the film was stopped and the participants given the opportunity to ask questions in order to completely eliminate confusion or doubt as to how the instructions were to be interpretated. The film was then re-started and allowed to run to completion; the responses were recorded by each individual while he observed the film, they were entered on the report or coding form (see Appendix B) during each pause in the film. The response reporting form was distributed prior to giving the verbal instructions about the film, the remaining portion of the questionnaire or data recording form was distributed after completion of the film projection. This avoided any diversion of interest during the film projection and prevented any of the questions in the later portion of the questionnaire from biasing any responses.

Each film was prepared in such a manner as to include a short section of film to accomplish the introductory task, that of exposing the subject to his task for the previously mentioned purposes. The film used in the introductory sections presented stimuli from the same sets as used in the main portion of each film and in the same manner so as to be completely compatible.

DATA COLLECTION AND CODING

Data collection from the group presentations was done with the aid of self-coding forms where possible, the majority of questions requiring only that a mark be made upon the form to indicate a reply. A copy of the complete set of forms used with both films is included in Appendix B; a summary of the coding used is given here. The format used for the punched cards is connection with this coding is indicated in Figure 1.

The technique used for reporting responses for the billboard film was the use of a horizontal line with negative responses located on the left hand side and positive responses located on the right hand side of the line -- indifference being the mid-point on the line. This form of graphical scale, with indicated intervals was judged best for the purposes of this investigation from a theoretical viewpoint and also a practical one as it proved the simplest to use out of those considered, particularly under the poor lighting conditions encountered during the film projection.

Responses to the billboard density film were recorded to the nearest indicated interval or tic-mark on the scale as the initial instructions to the participants asked for responses using only the tic-mark locations. These responses were coded alphabetically on the following basis for each film section, using the letters shown and selecting the one for the indicated position:

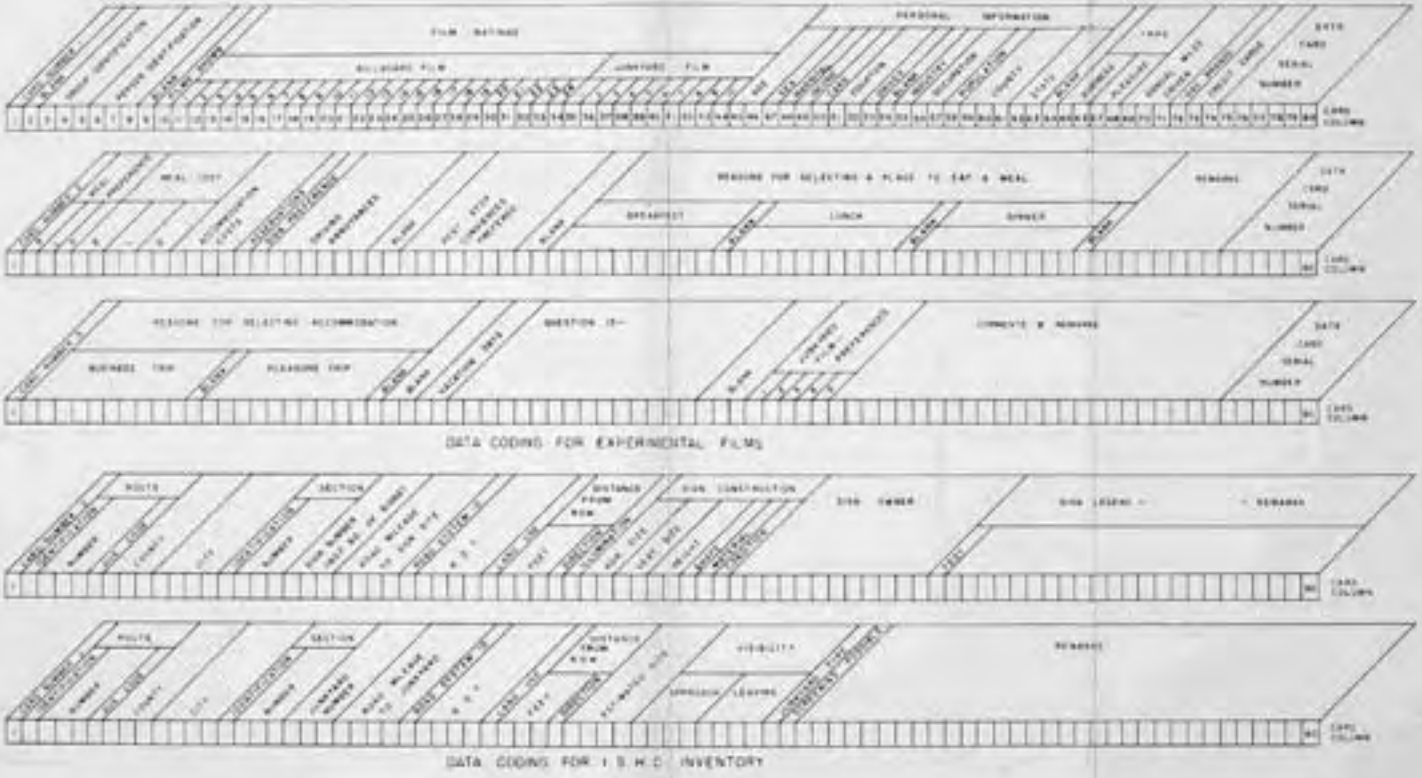
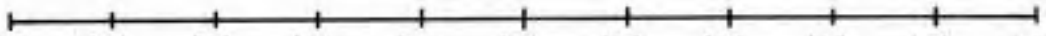


FIGURE 1. FORMAT FOR DATA CODING SHEETS AND PUNCHED CARDS.

DISLIKE* LIKE*

1. 
(A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K)

incorrect response or no response coded as (L)

* for complete description of form see Figure B2, Appendix B.

Responses to the junkyard screening film were coded as follows: 1 if stimulus 'a' was indicated, 2 if stimulus 'b' was indicated, and 0 if either no response or an incorrect response was given, for the first portion of the film; responses for the second portion were coded as 0 for disliking and 1 for liking. These are illustrated in the following examples:

(Pair Comparison Scaling)

1. X a ___ b (code as 1)
2. ___ a X b (code as 2)
3. X a X b (code as 0)
4. ___ a ___ b (code as 0)
5. ___ a X b (code as 2)

(Absolute Scaling)

1. ___ (code as 0)
2. X (code as 1)
3. ___ (code as 0)
4. X (code as 1)
5. ___ (code as 0)

The second phase of the data collection was common to both film presentations, the following summary indicates the manner in which the responses to the questionnaire (see Appendix B) were coded for tabulations by the computer from the punched cards. The numbers indicated next to the responses were those used for coding for the following series of questions:

A. Personal Information:

1. Age

01	less than 20	05	36 to 40	09	56 to 60
02	21 to 25	06	41 to 45	10	61 to 65
03	26 to 30	07	46 to 50	11	66 to 70
04	31 to 35	08	51 to 55	12	71 or more

- incorrect responses coded as 99
  no response coded as 00

2. Sex

1 Male 2 Female

incorrect response coded as 9
no response coded as 0

3. Marital Status

1 Single 2 Married 3 Widowed 4 Divorced

incorrect response coded as 9
no response coded as 0

4. Income

1	$	0 to 5,000 per year
2		5,000 to 7,500 per year
3		7,500 to 10,000 per year
4		10,000 to 15,000 per year
5		15,000 to 25,000 per year
6		25,000 or more per year

incorrect response coded as 9
no response coded as 0

5. Cars

0 - 8 Cars

incorrect or no response coded as 9

6. Education

Never attended school 01

Elementary school 02

High school 03/10* 04/11* 05/12* 06/13*

College 07/1* 08/2* 09/3* 10/4* 11/5* 12/6(+)*

incorrect response coded as 99
no response coded as 00

* indicates year in high school or college

7. Driver's License?

1 Yes 2 No

incorrect response coded as 9
no response coded as 0

The following two questions were coded according to the Industry and Occupation Codes as used in the Indianapolis Regional Transportation and Development Study, a short summary of which is included here:

8. Industry 0 to 9*

* responses were written in by the participant and the code used selected from the list below

Code	Description
0	Extractive and Miscellaneous
1	Retail Trades
2	Services, Personal, Business & Professional
3	Wholesale Trades
4	Manufacturing
5	Utilities, Communications, Transportation
6	Governmental, Institutional, Religious
7	Public Service -- Outdoor
8	Agriculture
9	Construction

9. Occupation 00 to 15*

* responses were written in by the participant and the code used selected from the list below

Code	Description
00	Professional, Technical
01	Farmers and Farm Managers
02	Managers, Officials, Proprietors

03	Clerical
04	Sales
05	Craftsman, Foremen, Armed Forces
06	Operatives
07	Private Household Workers
08	Service Workers
09	Laborers and Farm Workers
10	Housewives
11	Students
12	Unemployed
13	Retired or Permanently Incapacitated
14	Unknown or Unclassified
15	Preschool Children

10. Population

0	less than 2,500
1	2,500 to 4,999
2	5,000 to 9,999
3	10,000 to 14,999
4	15,000 to 24,999
5	25,000 to 49,999
6	50,000 to 99,999
7	100,000 to 199,999
8	200,000 to 499,999
9	500,000 or more

11. County and State

001-092 County 01-52 State

Counties were coded for the State of Indiana only, in alphabetic order (see Table A3, Appendix A)

States were coded in alphabetic order for 01-50, and with:

51 - District of Columbia
52 - Canada

B. Travel Information:

1. Auto Trips

00-98 Business 00-98 Pleasure

incorrect or no response coded as 99

2. Miles Driven

000-998 Miles*

incorrect or no response coded as 999

* coded in increments of 100 miles

3. Use same brands of gasoline?

1 Yes 2 No

incorrect response coded as 9
no response coded as 0

4. Credit Cards

00-98 Credit Cards

incorrect or no response coded as 99

5. Meal Preference

1-4 Breakfast 1-4 Lunch 1-4 Dinner

1 - R(restaurant)
2 - C(cafeteria)
3 - CS(counter service)
4 - P(picnic)

incorrect response coded as 9
no response coded as 0

6. Meal Cost

00-98* Breakfast 00-98* Lunch 00-98* Dinner

incorrect or no response coded as 99

* coded in increments of $0.10

7. Accommodation Cost

0000-9998* Dollars

incorrect or no response coded as 9999

* coded in increments of $0.01

8. Reservations

1 Yes 2 No

incorrect response coded as 9
no response coded as 0

9. Freeway Signing for Services

_1_ Notification of: "SERVICES," etc.
_2_ Notification of service type: "GAS," etc.
_3_ Services by brand names: Standard," etc.
_4_ Service availability: "GAS 1 mi.," etc.

incorrect response coded as 9
no response coded as 0

10. Order of Annoyancés

_1-6*_ Confusing or inadequate signs
_1-6_ Billboards along highway
_1-6_ Lack of services along freeway
_1-6_ Unclean restrooms
_1-6_ Traffic
_1-6_ Inept or incompetent drivers

incorrect response coded as 9
no response coded as 0

* as ranked by the participant, ties allowed

11. Conveniences

_0-1_ Telephone
_0-1_ Restrooms
_0-1_ Night Lighting
_0-1_ Overnight Camping Space
_0-1_ Drinking Water
_0-1_ Picnic Tables
_0-1_ Information Aids, etc.

Coded as 0 if left blank
Coded as 1 if checked by participant

12. Information Aid for Choosing a Place to Eat*

_1-9_ Credit Cards honored
_1-9_ National advertising
_1-9_ Recommended by someone
_1-9_ Price
_1-9_ Billboards
_1-9_ Appearance (outside)
_1-9_ Repeat visit
_1-9_ Chain affiliation
_1-9_ Guide Book recommendation
_1-9_ Other

incorrect or no response coded as 0

* items listed in order of appearance for each of three meals:

BREAKFAST
LUNCH
DINNER

13. Information Aid for Choosing a Place to Obtain Accommodations*

1-9 Credit Cards honored
1-9 National advertising
1-9 Recommended by someone
1-9 Price
1-9 Billboards
1-9 Appearance
1-9 Repeat visit
1-9 Chain affiliation
1-9 Guide Book recommendation
1-9 Other

incorrect or no response coded as 0

* items listed in order of appearance for each of two types of travel:

TRAVEL FOR BUSINESS PURPOSES
VACATION AND RECREATION TRAVEL

(Note: For questions 12 and 13, if all nine items are ranked, then the code 0 may also be used as the number 10 which is a legal option in the program. Unranked items are left blank in the coding.)

14. Vacation Days

00-98 Days*

incorrect or no response coded as 99

* legal responses included weeks and months which were transformed into days by:

1 week = 5 days
1 month = 22 days

15. Opinion Statements Check List

0-1 Billboards are interesting along the highway

0-1 Junkyards are ugly sights along the highway

0-1 I rely on billboards to find services needed when travelling

0-1 Junkyards should be fenced in and planted so as to hide them from view from the road

0-1 All billboards should be removed from the roadside

0-1 I do not rely on billboards to find services needed when travelling

0-1 Billboards are ugly sights along the highway

0-1 Billboards should not be removed from the roadside

0-1 Junkyards are interesting sights along the highway

0-1 Billboards are necessary to provide information to the motorist

0-1 Junkyards should be removed from the roadside

0-1 Many billboards should be removed from the roadside

0-1 Junkyards should not be removed from the roadside

0-1 Billboards are not really needed to provide information to the motorist

0-1 Junkyards are not ugly sights along the highway

Coded as 0 if left blank
Coded as 1 if checked by the participant

16. a) Billboards are _____ .

b) Junkyards are _____ .

(Note: This last question was not coded for computer analysis, rather it was reviewed directly.)

ANALYTICAL PROCEDURES AND RESULTS

The Scaling Model

Torgerson (39) presents a descriptive introduction to the basis of what might be termed 'modern psychophysical theory' that is essentially based upon the work and proposals of L. L. Thurstone. In 1927 Thurstone proposed a "judgement scaling model," a mathematical model for relating scale values of a set of stimuli to observable proportions, which is briefly outlined here; for a more detailed description the reader is referred to either Torgerson (39) or Guilford (16), or may consult the original report in the Psychology Review, Volume 34, 1927, titled "A Law of Comparative Judgement."

In brief , the model is as follows: take a given set of stimuli to which a subject may respond differentially with respect to some given attribute, the task is then to locate these stimuli on a psychological continuum in a way that accounts for the response given by the subject. Each stimulus, when presented to the subject, gives rise to what Thurstone has termed 'a discriminal process,' a process of reaction to the stimulus which, due to momentary fluctuations, does not always yield the same value on the psychological continuum. Thus a number of discriminal processes may be associated with a given stimulus, and for which a frequency distribution on the psychological continuum may be created. Thurstone's postulate is that such a distribution with which the

discriminal processes are associated for any given stimulus forms a 'normal' distribution on the psychological continuum. Thus the scale value of a stimulus on the psychological continuum is taken as the modal discriminal process which, for a normal distribution, is the same as the median and mean. The standard deviation of the distribution is referred to as the 'discriminal dispersion,' which may vary with varying stimuli. Figure 2 is such a model showing both a psychological continuum and four stimuli-associated distributions, the scale value for each stimulus being that of the associated modal discriminal process as indicated by

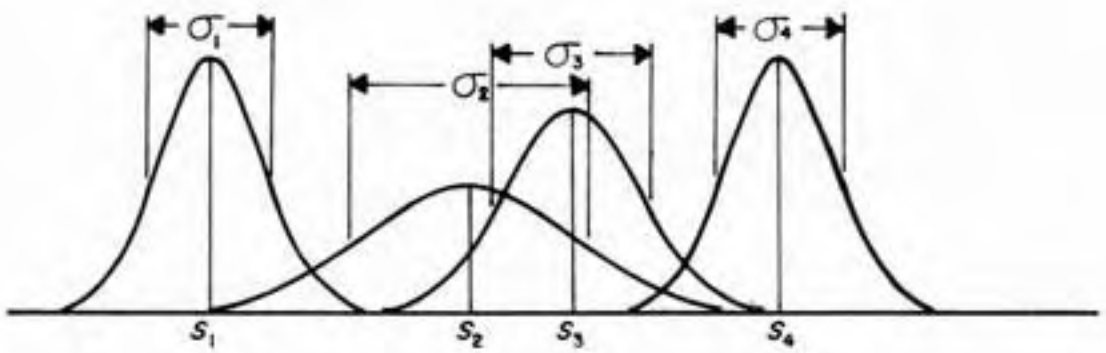


FIGURE 2. DISTRIBUTION ON THE PSYCHOLOGICAL CONTINUUM OF DISCRIMINAL PROCESSES ASSOCIATED WITH FOUR STIMULI.

s_1, s_2, s_3 and s_4. Each stimulus also is characterized by it's associated discriminal dispersion as indicated by σ_1, σ_2, σ_3 and σ_4.

It is not possible to scale the stimuli directly but equations relating judgements of 'relations among stimuli' reports from the subject to the scale values and discriminal dispersions may be deduced. These are used to estimate the scale values and dispersions for the stimuli. Torgerson refers to one such set of equations as the "Law of Comparative Judgement" and another as the "Law of Categorical Judgement."

The Method of Paired Comparisons

An experimental procedure based upon the application of the "Law of Comparative Judgement" is known as the method of 'pair comparisons.' The development of the theory and experimental models is omitted here, but may be found in both Torgerson and Guilford if the reader is interested in pursuing the details. The particular application used in this study for the junkyard data is covered in detail here, following the basic outline as given by Guilford. Computer programs for the actual analysis were developed on the basis of this outline and are presented in Appendix C.

In the method of pair comparisons each stimulus is paired with all other stimuli, each pair is presented to the subject who's task is then to indicate which one of the pair is greater with respect to the attribute to be scaled. In order to obtain data from which proportions may be estimated it is necessary for a large number of comparisons to be made for each pair of stimuli. As the interest is in the average scale for a population, a large number of subjects are used to judge each pair once.

In the usual method of pair comparisons a stimulus is not compared with itself. In addition, no real provision is made in this technique for time or space errors, plus a number of other factors, thus it becomes necessary to control experimentally as many of the conditions as possible that might introduce biasing effects. Most of these factors may be controlled by the assignment of the relative positions of the members of each pair and by the ordering of the presentation of the pairs themselves. Ross (33) gives an optimal solution for this ordering for

from five to seventeen stimuli, as well as a general outline of the procedure to use in so ordering the stimuli. In addition, careful wording of the instructions aids in controlling several potential sources of error.

To overcome two other possible problems the subjects in this experiment were presented with several typical illustrative stimuli before being asked to perform the experimental task. This aided in reducing the variance in responses due to 'learning' on the part of the subjects while taking part in the experiment -- in this way the subject was made somewhat familiar with the task and the type of stimuli. This also aided in anchoring and expanding the scale that was derived, as the stimuli selected for this purpose covered the entire range for the attribute being studied, thus achieving a more reliable and reproducable scale. Both of these problems may otherwise have proved impossible to overcome, particularly as the responses are actually a form of aesthetic judgement and as such are subject to any number of possible influences. By using this introduction to the task and then by carefully repeating some of the instructions it was possible to better control the actual basis upon which the responses were given -- that is, according to the attribute upon which the choice was based.

The responses of the subjects are taken as comparative judgements. By combining all judgements for all subjects, a 'P' or proportion matrix is created, such as is illustrated in Table 1. The scaling problem begins with the P matrix, from which a single value for each stimulus is determined that, it is hoped, will be on a linear scale with the properties of an interval scale. These proportions represent estimates

for finding the difference $R_j - R_k$ in the equation :

$$R_j - R_k = z_{jk}\sqrt{\sigma_j^2 + \sigma_k^2 - 2r_{jk}\sigma_j\sigma_k}$$

where: R_j and R_k = mean values for the discriminal processes that are characteristic of the stimuli s_j and s_k, respectively

z_{jk} = standard deviate from the mean of a unit normal distribution

σ_j and σ_k = standard deviations for the distributions of the discriminal processes for the stimuli s_j and s_k, respectively

r_{jk} = coefficient of correlation between R_{hj} and R_{hk}, respectively

R_{hj} and R_{hk} = response arrising on occasion O_h from stimuli s_j and s_k where individuals may be substituted for occasions

and $R_{hj} = R_j + e_{hj}$

where: e_{hj} = error or deviation of R_{hj} about 'true' response R_j

and e_{hj} is assumed to vary at random with:

$$\Sigma\, e_{hj} = 0.00$$

The value of z_{jk} is determined from a knowledge of the experimental proportion $p_{j>k}$ and all the remaining parameters are unknown. There are two experimental models that were of use in this research from among those Thurstone has identified, he calls these Case III and Case V. In Case III it is assumed that the correlation between the responses to any pair of stimuli, or that r_{jk}, is equal to zero; with this the equation reduces to:

$$R_j - R_k = z_{jk}\sqrt{\sigma_j^2 + \sigma_k^2}$$

which may now be evaluated. In Case V the further assumption is made that the discriminal dispersions are equal; if $\sigma_j = \sigma_k$ the equation reduces to:

$$R_j - R_k = z_{jk}\sigma_j\sqrt{2}$$

and if the unit of the scale is taken as $\sigma_j\sqrt{2}$ then the equation reduces to:

$$R_j - R_k = z_{jk}$$

Guilford points out that it is not necessary to assume zero correlation in Case V, only equal correlation for all pairs and the unit of separation would become $\sigma_j\sqrt{2(1 - r)}$ and the relationship $R_j - R_k = z_{jk}$ still holds, this case is designated Case Va. The risk involved in making any of these assumptions is small as a statistical test is made on the validity of the assumptions.

This technique was used in the analysis of the entire data set gathered for the junkyard experiment. In effect the attribute being scaled was the percent of screening and was represented by five stimuli. The number of pairs for 'n' stimuli was $n(n - 1)/2$ and with $n = 5$, there were 10 pairs. There were a number of responses to each pair which in effect formed a matrix of raw frequencies for the number of times each stimulus was preferred to each other stimulus by the entire sample group. This was transformed into a proportion matrix, Table 1. The additional assumption that the proportion for the comparison of a stimulus with itself is 0.500 was made, thus the matrix was completed as the remaining positions were completed by subtraction from 1.000 for the symmetrically opposite positions in the matrix.

The initial solution was made assuming the experimental model for Case V. Starting with the proportions from the 'P' matrix, and using a table of deviates for a normal distribution, a corresponding 'Z' matrix was created, as illustrated in Table 2. Each deviate represented an

TABLE 1. PROPORTION MATRIX -- SHOWING PROPORTION OF TIMES EACH STIMULUS AT THE TOP WAS JUDGED GREATER THAN EACH STIMULUS AT THE SIDE.

P =

	S_{00}	S_{20}	S_{40}	S_{60}	S_{80}
S_{00}	.5000	.8211	.8526	.7474	.8105
S_{20}	.1789	.5000	.6947	.3158	.5895
S_{40}	.1474	.3053	.5000	.1579	.4737
S_{60}	.2526	.6842	.8421	.5000	.6105
S_{80}	.1895	.4105	.5263	.3895	.5000

S_{00} = junkyard stimulus with 0% screening

TABLE 2. SCALE SEPARATION MATRIX 'Z' ASSUMING CASE V.

Z =

	S_{00}	S_{20}	S_{40}	S_{60}	S_{80}
S_{00}	0.0000	0.9194	1.0478	0.6662	0.8798
S_{20}	-0.9194	0.0000	0.5093	-0.4795	0.2262
S_{40}	-1.0478	-0.5093	0.0000	01.0031	-0.0660
S_{60}	-0.6662	0.4795	1.0031	0.0000	0.2807
S_{80}	-0.8798	-0.2262	0.0660	-0.2807	0.0000
$M_{z_{jk}}$	-0.7026	0.1327	0.5253	-0.2194	0.2641
R_j	0.0000	0.8353	1.2279	0.4832	0.9668

S_{00} = junkyard stimulus with 0% screening

$M_{z_{jk}}$ = mean of the column

R_j = adjusted to all positive values from means

estimate of the distance $R_j - R_k$; by averaging the values for each column a mean estimate of the scale separation was found which was designated $M_{z_{jk}}$. In order to eliminate the negative sign the value of the smallest mean was added to all of the means, thus arriving at the scale represented by R_j.

The unit of the R_j scale is equal to $\sigma_j\sqrt{2}$ for Case V or $\sigma_j\sqrt{2(1 - r)}$ for Case Va. If the discriminal dispersions are not equal for each pair, then the unit for the means is an average of them all. Guilford points out that this procedure is essentially a least-squares solution. He also adds the cautioning note that when the proportions are extreme, the scale derived from them may be in error. It is common practice to use only proportions in the range 0.023 to 0.977. While such a procedure may result in vacancies in the 'Z' matrix, such was not the case in this particular problem -- if this does occur a procedure is available that takes account of the vacancies. The computer program prepared for this analysis has this feature in it, and allows the user to select the range of proportions acceptable for use in the problem. In studying some of the subgroupings used for the raw data, this range was varied but the best results were obtained using the above mentioned range. In some of these instances, vacancies did occur in cells in the 'Z' matrix. The procedure used to take these into account involves determining the mean using only the cells that have entries and averaging by only the number of cells that are used.

A test of internal consistency consists of trying to reproduce the original judgements from the scaling model and then testing the difference when compared to the observed proportions. To do so a Z' matrix

is created containing the expected scale separations; this is done by using the R_j scale and making all possible subtractions of pairs to arrive at the matrix. From the expected scale separations the expected proportions are found by using a table of proportions for a normal distribution; these then make the matrix P'. The procedure for comparing these proportions to the observed proportions uses an arcsine transformation to create the statistic θ, this is done to correct for the non-normality of the distribution of proportions in the region close to 1.00 and gives a resulting statistic having a normal distribution. This is illustrated by the following equations:

$$\theta = \text{arcsine } P$$

$$\theta' = \text{arcsine } P'$$

where θ and θ' are expressed in degrees. The resulting test for internal consistency may now be expressed as:

$$\chi^2 = \frac{N}{821}\Sigma(\theta - \theta')^2$$

where N = number of judgements per stimulus pair. This may be interpretated as the usual 'chi square' distribution where the degrees of freedom found by:

$$df = \frac{(n - 1)(n - 2)}{2}$$

where n = number of stimuli.

For the junkyard data set, the chi square was found to be 14.26 with 6 degrees of freedom. Checking this against the chi Square table it was found non-significant beyond the 0.01 level.

The conclusion drawn from this analysis is that the assumption of Case V is probably not valid, the causes of this could include a lack of

normality, lack of unidimensionality or unequal standard deviations. The next step was to apply the assumptions of Case III to see if the scaling could be improved. For the Case III solution an approximation must be made for estimating the standard deviations of the stimuli. This is done by using the relationship:

$$\sigma_j \doteq \frac{c}{V_{z_j}}$$

where: σ_j = the standard deviation for the dispersion of stimulus s_j

V_{z_j} = variance of deviates z_{jk} in each column of the Z matrix from the column mean $M_{z_{jk}}$

and 'c' is estimated by the relationship:

$$c \doteq \frac{n}{\sum \frac{1}{V_{z_j}}}$$

where: n = number of stimuli

In the solution assuming Case III the estimate is:

$$R_j - R_k = z_{jk}\sqrt{\sigma_j^2 + \sigma_k^2}$$

where σ_j and σ_k are estimates of the standard deviations associated with stimulus s_j and s_k, respectively. From this point the procedure is as for the solution under the assumption of Case V, the difference being the estimate is now $z_{jk}\sqrt{\sigma_j^2 + \sigma_k^2}$ in place of z_{jk}. The resulting Z_3 matrix for the junkyard data is illustrated in Table 3. In a similar manner both the scales $M_{3z_{jk}}$ and R_{3_j} were obtained from the Z_3 matrix.

TABLE 3. SCALE SEPARATION MATRIX Z_3 ASSUMING CASE III.

Z_3 =

	S_{00}	S_{20}	S_{40}	S_{60}	S_{80}
S_{00}	0.0000	1.3265	1.6285	0.9321	1.7820
S_{20}	-1.3265	0.0000	0.5710	-0.4285	0.3880
S_{40}	-1.6285	-0.5710	0.0000	-1.0675	-0.1195
S_{60}	-0.9321	0.4285	1.0675	0.0000	0.4713
S_{80}	-1.7820	-0.3880	0.1195	-0.4713	0.0000
$M_{3z_{jk}}$	-1.1338	0.1592	0.6773	-0.2070	0.5044
R_{3_j}	0.0000	1.2930	1.8111	0.9268	1.6382

S_{00} = junkyard stimulus with 0% screening

The test for internal consistency is again similar to that used in the Case V analysis; however, the relationship now becomes:

$$z'_{3_{jk}} = \frac{R_j - R_k}{\sqrt{\sigma_j^2 + \sigma_k^2}}$$

These values are transformed into θ'_3 values in the same manner as for Case V and the relationship:

$$\chi^2 = \frac{N}{821}\Sigma(\theta - \theta'_3)^2$$

is used to evaluate the chi square. The associated degrees of freedom are now found by:

$$df = \frac{(n - 1)(n - 4)}{2}$$

For this data set, the chi square was found to be 3.96 with 2 degrees of freedom. Checking this against the chi square table it was found non-significant beyond the 0.15 level. The drop in the chi square is numerically large in going from the Case V to the Case III solution and there is some change in the scale values for these stimuli. Guilford recommends using the 0.01 level for testing hypotheses in this solution technique, however the marked improvement in this case seems to warrent the application of the Case III model. The correlation between the two scales was 0.958 (R) for linear correlation.

There is nothing about the data for a pair comparison solution that will aid in directly locating a psychologically meaningful zero point. To accomplish this objective the attribute being studied was also used in a direct scaling procedure involving dichotomous judgements. These

judgements were essentially those of "liking" or "disliking" the stimuli. The same set of stimuli and the same subjects were used in this procedure, with the stimuli being presented to the subjects one at a time for their judgement. From these judgements the proportion of judgements that were favorable was used and their corresponding deviates were found from a normal distribution table. These deviates are labeled 'a_j' in Table 4. The scaling procedure assumed that the discriminal dispersion was normal for each stimulus. The a_j values may be thought of as representing distances from an indifference point that separates liking from disliking on the preference scale; it is expected that these a_j values are linearly related and highly correlated with the scale values found by pair comparisons. This was tested by linear regression analysis with a resulting correlation coefficient of 0.9546 (R^2 = 0.9113) being found, thus substantiating the validity of the assumptions stated previously. The corresponding value on the M_{3z} scale for a_j = 0 was found by the use of the regression equation from this test; the stimuli were then shifted on the M_{3z} scale in such a way that zero would represent indifference; the resulting scale was labeled R_c and is shown in Table 4.

TABLE 4. SCALE VALUES DERIVED FROM ABSOLUTE SCALING OF STIMULI AND A LINEAR TRANSFORMATION OF PAIR-COMPARISONS SCALE VALUES, CASE III.

	S_{00}	S_{20}	S_{40}	S_{60}	S_{80}
a_j	-1.9808	-1.1219	-0.1800	-1.0676	-0.4972
R_c	-2.0284	-0.7354	-0.2173	-1.1016	-0.3902

S_{00} = junkyard stimulus with 0% screening

Successive Categories

An experimental procedure based upon the application of the "Law of Categorical Judgements" is known as the 'method of successive categories.' The development of the theory and the experimental models is omitted here, but may be found in both Torgerson (39) and Guilford (16) if the reader is interested in pursuing the details. The particular application used for the billboard study is covered in detail here, following the basic outline as given by Guilford. Computer programs for the actual analysis were developed on the bases of this outline and are presented in Appendix C.

The experimental procedure used basically consisted of judging each of a number of stimuli as belonging in one of a limited number of categories differing quantitatively along a defined continuum. The categories used were not assumed to be equal intervals on a continuum but they were assumed to be in the correct rank order. Their bounderies were assumed to be stable except for sampling errors. The analytical procedure used estimated the values of these category limits, along the psychological continuum, and from these reference values derived interval-scaling measurements of the stimuli.

The critical assumption in this procedure was that the distribution of responses to a stimulus is normal on the psychological continuum. The scaling procedure began with the cumulative frequency matrix of the billboard data (Table 5). This matrix was created by ascertaining the frequency with which each stimulus was placed in each category, then by transforming these frequencies to cumulative proportions. The cumulative proportions were taken to represent the areas under a unit normal

TABLE 5. CUMULATIVE PROPORTIONS FOR JUDGEMENTS OF 9 STIMULI IN 11 SUCCESSIVE CATEGORIES.

Stimulus	Successive Categories										
	1	2	3	4	5	6	7	8	9	10	11
1	0.000	0.015	0.110	0.150	0.320	0.430	0.565	0.665	0.930	0.980	1.000
2	0.010	0.035	0.125	0.215	0.335	0.425	0.600	0.690	0.855	0.955	1.000
3	0.010	0.020	0.075	0.145	0.305	0.395	0.615	0.710	0.890	0.970	1.000
4	0.020	0.040	0.135	0.235	0.430	0.590	0.745	0.820	0.975	0.985	1.000
5	0.015	0.055	0.195	0.325	0.550	0.715	0.855	0.930	0.985	0.995	1.000
6	0.055	0.125	0.260	0.410	0.585	0.715	0.835	0.895	0.975	0.995	1.000
7	0.135	0.285	0.580	0.725	0.850	0.900	0.960	0.975	1.000	1.000	1.000
8	0.235	0.405	0.630	0.750	0.825	0.855	0.935	0.960	0.985	0.990	1.000
9	0.150	0.275	0.605	0.755	0.865	0.890	0.920	0.950	0.985	0.985	1.000

distribution. This procedure led to a 'Z' matrix (Table 6), each element of which is represented by z_{jk} where j stands for the stimulus and k for the category involved.

Each z_{jk} element may be thought of as a measurement of the distance of the upper limit of the category k from the mean of the stimulus j. Due to differences in means and in standard deviations, the deviates in any one column are not equal, rather each represents an estimate and scale with its own unit and origin. However, from these estimates it was possible to evaluate all of the bounderies between categories except the lower limit of the first category and the upper limit of the last category, as the proportions for these are 0 and 1 respectively and which have corresponding deviates that are infinite.

Guilford points out that some researchers advise against using deviates corresponding to proportions outside the range of 0.05 to 0.95 but that others, himself included, have sucessfully used proportions as low as 0.01. The reason behind such a practice may be better seen in the discussion of testing for internal consistency; in this investigation several limiting ranges of proportions were studied and the range used in the final analysis was 0.01 to 0.99. The computer programs used allow the user to select the desired range. The results from the analysis using a more restrictive range proved to be the same and were almost perfectly correlated with the results used.

The analytical procedure began with the Z matrix and an initial assumption of equality of dispersions for the various stimuli. The possibility of a vacant cell in the Z matrix due to a proportion being outside the acceptable range precluded the most direct possible approach

TABLE 6. DISTANCE, IN Z UNITS, OF UPPER CATEGORY LIMITS FROM MEAN OF EACH OF 9 STIMULI.

Stimulus	Successive Categories										
	1	2	3	4	5	6	7	8	9	10	11
1	-	-2.170	-1.227	-1.036	-0.468	-0.176	0.164	0.426	1.476	2.054	-
2	-2.326	-1.812	-1.150	-0.789	-0.426	-0.189	0.253	0.496	1.058	1.695	-
3	-2.326	-2.054	-1.440	-1.058	-0.510	-0.266	0.292	0.553	1.227	1.881	-
4	-2.054	-1.751	-1.103	-0.723	-0.176	0.228	0.659	0.915	1.960	2.170	-
5	-2.170	-1.598	-0.860	-0.454	0.126	0.568	1.058	1.476	2.170	-	-
6	-1.598	-1.150	-0.643	-0.228	0.215	0.568	0.974	1.254	1.960	-	-
7	-1.103	-0.568	0.202	0.598	1.036	1.282	1.751	1.960	-	-	-
8	-0.723	-0.240	0.332	0.675	0.935	1.058	1.514	1.751	2.170	2.326	-
9	-1.036	-0.598	0.266	0.690	1.103	1.227	1.405	1.645	2.170	2.170	-

in the treatment of the deviates; rather it was necessary to determine estimates of the category widths by subtracting the deviates by pairs down adjoining columns. This led to a matrix of mean separations as illustrated in Table 7. The means of each column are average estimates of the category widths and are denoted in Table 8 as the w scale. It will be noted that some cells in this matrix are blank and some are zero; the blanks are not included in the determination of the mean widths but the zero cells are. Cumulating these estimates of the interval widths gave scale values for the limits of the categories on an interval scale; this scale is denoted as L_c in Table 8. These values apply to the upper limits of the categories; from them the mid-point was estimated for the categories by using the means of successive pairs of limits and by assuming the lower limit of the first category to be equal to zero. These mid-points are denoted as M_c in Table 8; they are more representative of the categories than are the limits.

The M_c scale is an interval scale with an arbitrary zero point located at the boundary between categories 1 and 2. However, the categories used represent a bipolar scale with a meaningfully located zero point supposedly located at the mid-point of category 6. By subtracting the value of this point from all the scale values on the M_c scale it was possible to create a scale, designated the A_c scale in Table 8, that has a meaningfully located zero point in terms of the categories used.

The stimuli may now have numerical values assigned to them, based upon the category scales previously developed. However, there are several limitations in the procedure as some of the distributions are truncated thereby making estimates of the means for the stimuli

TABLE 7. MEAN SEPARATIONS BETWEEN NEIGHBORING UPPER CATEGORY LIMITS AS ESTIMATES OF CATEGORY WIDTHS.

Stimulus	Successive Categories										
	1	2	3	4	5	6	7	8	9	10	11
1	-	-	0.944	0.190	0.569	0.291	0.340	0.263	1.050	0.578	-
2	-	0.514	0.662	0.361	0.363	0.237	0.443	0.243	0.562	0.637	-
3	-	0.273	0.614	0.381	0.548	0.244	0.559	0.261	0.673	0.654	-
4	-	0.303	0.648	0.381	0.546	0.404	0.431	0.257	1.045	0.210	-
5	-	0.572	0.739	0.406	0.579	0.442	0.490	0.418	0.694	-	-
6	-	0.448	0.507	0.416	0.442	0.353	0.406	0.280	0.706	-	-
7	-	0.535	0.770	0.396	0.439	0.245	0.469	0.209	-	-	-
8	-	0.482	0.572	0.343	0.260	0.124	0.456	0.237	0.419	0.156	-
9	-	0.439	0.864	0.424	0.413	0.124	0.179	0.240	0.525	0.000	-

TABLE 8. FOUR SCALES FOR CATEGORY LIMITS AND MIDPOINTS.

Scales	Successive Categories										
	1	2	3	4	5	6	7	8	9	10	11
w		0.446	0.702	0.366	0.462	0.274	0.419	0.268	0.709	0.373	
L_c		0.446	1.148	1.514	1.976	2.250	2.669	2.937	3.646	4.019	
M_c		0.223	0.797	1.331	1.745	2.112	2.459	2.802	3.291	3.833	
A_c		-1.889	-1.315	-0.781	-0.367	0.000	0.347	0.690	1.179	1.721	

inaccurate. The procedure used here estimated the scale value of each stimulus by using the median of its associated frequency distribution on the L_c scale. These values were interpolated from the deviate matrix, Table 6, and are given in the second column in Table 8. The value used corresponds to the scale position of the 0.500 proportion or zero deviate for each stimulus frequency distribution.

Direct evaluation of the dispersion of the frequency distribution for each stimulus was not possible as the two terminal categories had no assigned values and due to the additional problem of truncation. By a regression of the deviates for each stimulus upon the category limits or L_c scale, however, it was possible to estimate the standard deviation for the stimuli on the psychological scale.

The ratio of σ_{z_j}/σ_L gave the slope of the linear regression line for a particular stimulus on the L_c scale. Such values indicated the degree of agreement of opinion about a particular stimulus; they are labeled σ_j in Table 9. A statistical test of the homogeneity of these variances may be made by applying Bartlett's Test for Homogeneity of Variance (29).

The obtained values for the stimuli were adjusted to a scale having a common meaningfully located zero point; this was done by subtracting the value of the midpoint for the category that represented indifference from each of the medians. The result gave a scale value for each stimulus on a common scale, designated the A_j scale in Table 9.

This scale was transformed into one having a given standard deviation so that all scales derived would indeed be common and thus could be directly compared; the standard deviation chosen for this purpose

TABLE 9. INTERPOLATED MEDIANS AND TRANSFORMED SCALE VALUES.

Stimulus	Median	A_j	R_c
1	2.4674	0.3542	2.8863
2	2.4297	0.3165	2.5791
3	2.4501	0.3369	2.7455
4	2.0961	-0.0171	-0.1394
5	1.8736	-0.2396	-1.9522
6	1.7518	-0.3613	-2.9444
7	0.9574	-1.1558	-9.4179
8	0.7421	-1.3710	-11.1720
9	0.9244	-1.1888	-9.6868

was 4.0. The transformation was made by multiplying each A_j value by the ratio $4/\sigma_{A_j}$, where σ_{A_j} is the standard deviation of the A_j scale previously arrived at; the results are denoted as the R_c scale in Table 9.

A statistical test of internal consistency was then made; such a test is constructed similarly to the test described for the Pair Comparisons method. The expected deviates are found by subtracting each category limit from the median for each stimulus. The expected proportions matrix may then be created by determining the corresponding ordinate from a normal distribution table of deviates and ordinates. The technique is then the same as that used for the Pair Comparison case; the proportions are transformed by an arcsine function into angular values, then the expression

$$x^2 = \frac{N}{821}\Sigma(\theta - \theta')^2$$

may be evaluated. The number of degrees of freedom associated with this expression is found by:

$$df = a(b - 1) - (a + (b - 2))$$

where: a = number of stimuli
b = number of categories

This procedure leads to degrees of freedom outside the range of most standard statistical tables but the expected chi square may be estimated by the expression:

$$\sqrt{2\chi^2} = N(0, 1) + \sqrt{2n - 1}\ *$$

* From "Statistical Tables for Biological Agriculture and Medical Research" by Fisher and Yates.

where: $N(0, 1)$ = deviate for a unit-normal distribution at the same confidence level

n = degrees of freedom

An additional quanitative check was made on the internal consistency by finding the average absolute value of the discrepancies between the corresponding cells of the two proportion matrixes. The results of these various checks on the billboard data are given below:

Bartlett's χ^2 = 16.2550 with 8 degrees of freedom

Internal Consistency χ^2 = 158.4169 with 72 degrees of freedom

Mean Discrepancy = 0.02194

The test for internal consistency gave a fairly good value for the mean discrepancy with the average being only 2.18 percent; however, the χ^2 was significant beyond the 0.99 level probably indicating that one or more of the initial assumptions were in error -- probably the assumption of normality of the distributions or of equivalence of dispersions. Bartlett's Test gave a χ^2 significant beyond the 0.95 level indicating that the assumption of equivalence of variances is probably in error.

In order to correct the scale values for this lack of homogeneity in the variances the following expression was used:

$$M_j = M_L - \sigma_j M_{z_j}$$

where: M_j = revised estimate of the median for stimulus j

M_L = mean of L_c scale

M_{z_j} = mean of the frequency distribution of the deviates for stimulus j

These values are labeled M_j and M_{z_j} in Table 10. This scale was again adjusted so as to have a meaningfully located zero point by subtracting the scale value for the midpoint of category 6, the category inferring indifference, from the scale values; the results are shown in Table 10 under the heading A_{j_2}. This scale was transformed to a common scale having a standard deviation of 4 by the method previously described; this scale is labeled R_{c_2} in Table 10.

Computer Programs

Computer programs were developed, as part of this investigation, that would perform the analysis for both techniques discussed -- pair comparisons and successive categories. While these programs were specifically designed for application in this project, the uncertain nature of the analysis meant that most of the aspects and options of both techniques needed to be included in the programs as there was some possibility that each option might be required. The entire group of subprograms has been combined into one main program in order to make most efficient use of some of the features required by each technique, such as the determination of normal curve deviates. These programs were written in FORTRAN IV and are designed to run on an IBM 7094, IBM 360 or CDC 6500 with only the machine control cards as required by each machine needing to be changed. In fact all three types of machines were used at one point or another in this project.

The complete listing of the programs is included in Appendix C along with a complete Systems Flow Chart for the programs. User documentation is also provided.

The output of the programs includes the proportion matrix for the

TABLE 10. CORRECTED MEANS, VARIANCES AND SCALES FOR 9 STIMULI.

Stimulus	σ_{z_j}	σ_j	M_{z_j}	M_j	A_{j2}	R_{c_2}
1	1.2490	0.8769	-0.1064	2.3826	0.2695	2.2557
2	1.0364	1.0567	-0.0960	2.3908	0.2776	2.3237
3	1.2002	0.9125	-0.1527	2.4287	0.3155	2.6413
4	1.2553	0.8725	0.2421	2.0781	-0.0351	-0.2939
5	1.1764	0.9310	0.3108	2.0000	-0.1132	-0.9473
6	0.9639	1.1363	0.3686	1.8704	-0.2427	-2.0318
7	0.8233	1.3302	0.8943	1.0997	-1.0135	-8.4839
8	0.8026	1.3645	1.1689	0.6944	-1.4188	-11.8764
9	0.8458	1.2949	1.1198	0.8392	-1.2740	-10.6642

data being analyzed, and all desired scales as well as the resulting statistics used for testing internal consistency and homogeneity of variance.

Analysis of Junkyard Screening Data

Analysis of the response data collected for the junkyard screening portion of this investigation, for the entire group of participants, gave a χ^2 test of internal consistency for the Case V solution that was significant beyond the 0.95 level while the test assuming Case III was not significant beyond the 0.85 level, thus indicating the assumptions of the Case III scaling model may be used with this data. The relationship found by linear regression between the scale values by pair comparisons and the scale values by absolute scaling yielded the relationship used for establishing a scale with a meaningfully located zero point. Figure 3 illustrates the relationship found between the scale values established by the two techniques which may be expressed as:

$$M_{3_z} = 0.92280a_j + 0.89456$$

This relationship had a correlation coefficient of 0.9546 or R^2 value of 0.9113. Using the resulting R_c scale, the psychological scale with a meaningfully located zero point, the relationship to the previously measured physical scale of percent screening was examined; the resulting relationship is shown in Figure 4. This relationship had a correlation coefficient of 0.640 and may be expressed as:

$$R_c = 0.01455d - 1.47662$$

where: d = percent screening

The plot of the points indicates the nature of the problem arising in this analysis. The lack of fit, when relating the scale values to the

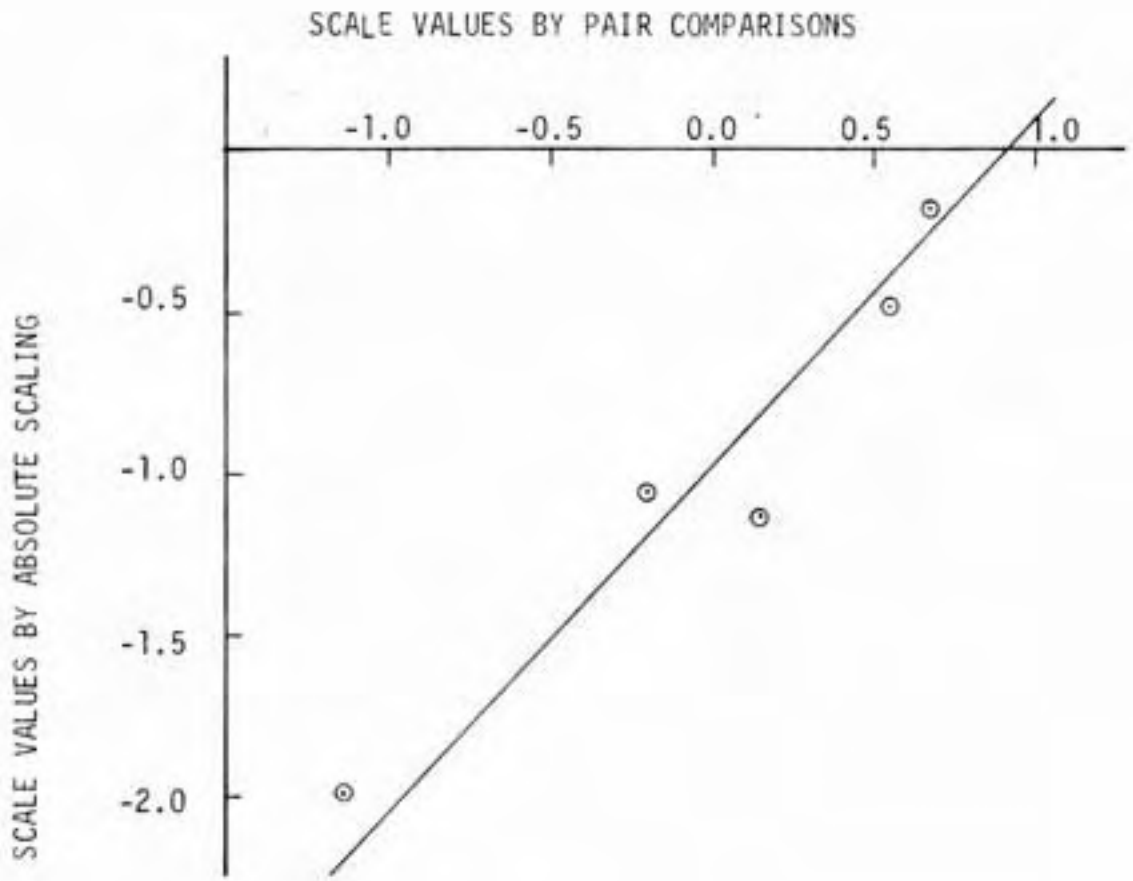


FIGURE 3. LINEAR TRANSFORMATION FUNCTION TO LOCATE A MEANINGFUL ZERO POINT.

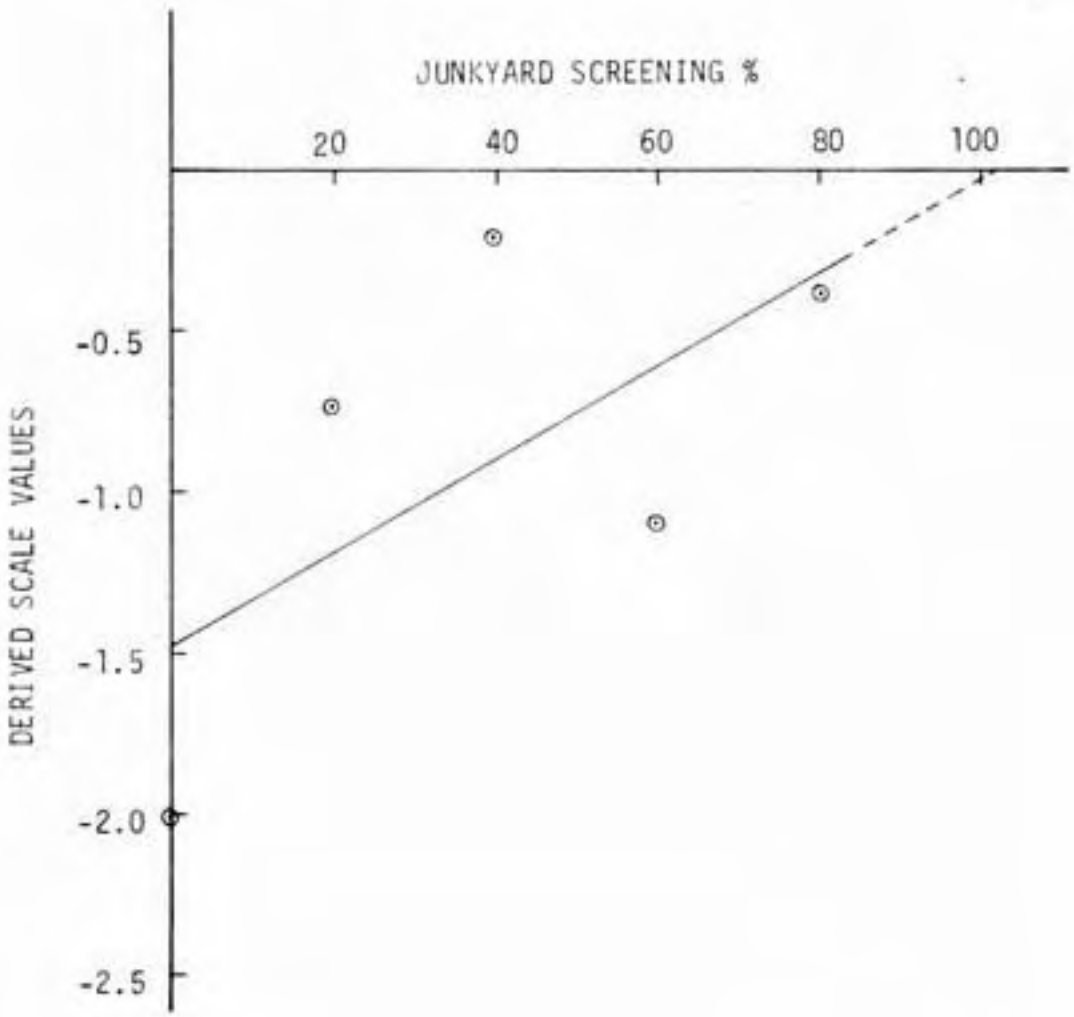


FIGURE 4. SCALE VALUES FOR JUNKYARD SCREENING.

percent screening scale, is apparent from the low correlation coefficient and is visibly confirmed in the plot, Figure 4.

The strong test result for internal consistency, coupled with the poor fit to the physical scale indicates that while the participants were in agreement, and gave consistent judgements, these judgements were not based entirely upon the attribute being scaled.

The junkyard film suffered from a lack of suitable sites for filming, particularly in terms of coverage of the complete range of screening. A site with 100 percent screening was not used as such a site would not be identifiable in the film as a junkyard; rather it was hoped inferences about the effect of 100 percent screening could be made from the analysis of the other junkyards. The sites actually selected were chosen to represent points approximately equally spaced throughout the range of percent screening studied, 0 - 80 percent. The sites filmed represented the best choices possible for the combination of criteria used in the selection process; however, the sites used were far from ideal. The primary objective was to depict varying percentages of screening by vegetation, but as the only sites found were screened by naturally occurring vegetation, as opposed to designed plantings, they appeared less than perfect for this purpose. For several of the sites the presence of adjacent features detracted somewhat from the suitability of the films. It was anticipated that this would not present a problem to the viewer; the results, however, may indicate that this was not true and that it was a problem for the viewer!

The nature of a pair comparison experiment -- the fact that the size of the experiment increases rapidly as additional stimuli are used,

led to the use of a small number of stimuli. As each stimulus required approximately 35 seconds of projection time, an increase in the number of stimuli from 5 to 6 would add 6 minutes to the viewing time and an increase to 7 stimuli would add 13 minutes, thereby almost doubling the time needed to conduct the experiment. As the intention was to use the film in presentations to groups with a limited amount of time available for taking part in the investigation, it was necessary to limit the running time to that required for 5 stimuli. This limited number of stimuli may also be a cause of the apparent lack of fit to the physical scale. There is also a possibility that the attribute being scaled is not unidimensional, this was not possible to investigate in this project.

The results indicated thus far are for the analysis of the data gathered considering all the participants as one group. The participants were grouped by several measures of socio-economic factors, on the bases of other information they provided, but the resulting scales were not different from the one for the entire group; there was no improvement in fit and none of the groupings showed any improvement in internal consistency.

This situation may be partly due to the size of the sample included in this analysis, 110 persons, which led to fairly small subgroupings; the results for the total group do indicate that not much improvement could be expected even if the sample was increased. The major problem apparently is the stimuli used, they do not well enough represent the attribute being scaled -- particularly on a unidimensional scale.

Analysis of Billboard Density Film Data

The initial analysis, made with the response data for all 210 individuals grouped into one sample, resulted in a χ^2 test of internal consistency that was not significant beyond the 0.99 level. This indicated that, for the sample considered this way, it was necessary to adjust the scale to account for the differences caused by unequal variances and deviations from normality in the distributions of responses. Examination of the response data at this point indicated the existance of two other probable causes of this lack of consistency. As a result one stimulus was discarded from the analysis on the basis of a poorer quality of photography than the remaining stimuli. This particular film section did not seem to adequately represent the billboard density associated with it; two other stimuli were also discarded from further analysis, these had initially been included as an attempt to extend the physical scale of density on the high end and bridge the lack of intervening stimuli.

The analysis of the revised data set then gave a test of internal consistency that was not significant beyond the 0.85 level, and in a test for homogeneity of variance (equality of dispersions) the resulting χ^2 from using Bartlett's Test was not significant beyond the 0.85 level. The mean of the differences between the observed and expected proportions was 0.01629. This all indicated that the assumptions made in using this analytical technique were not violated and that a reliable and reproducable scale had been generated for the stimuli included.

The discarding of a selected few of the stimuli from the analysis presents no problem in practice nor does it conflict with the theory of

the analytical technique used. It had been expected at the outset of the project that attempts to extend the billboard density scale on the high end might not prove successful, particularly as the stimuli chosen for this purpose were not on an equal interval scale with the remainder of the sections used. The resulting improvement in internal consistency after eliminating the stimuli judged unsatisfactory indicated that the area of main concern had been well covered according to the objectives of the project.

Various socio-economic information, summarized elsewhere, had also been collected from all of the participants in this phase of the project. Using several of these variables, the participants were divided into subgroupings in an attempt to study any systematic trends that might exist in the pattern of responses to the film; the findings are presented in Table 11. In this Table, Bartlett's χ^2 is the resulting statistic from the use of Bartlett's Test for Homogeneity of Variance; the mean of the discrepancies between the observed and expected proportions is reported as $\overline{\Delta}$; the chi square (χ^2) test for internal consistency is reported assuming equality of dispersions and normality of distributions. No test for internal consistency was significant beyond a level of 0.85 while only two subgroups had a significant χ^2 for Bartlett's Test beyond the 0.99 level although even these two were very close, perhaps applying Bartlett's correction would have resulted in a non-significant χ^2 for these two also.

Regression analysis was used to study the relationship between the psychological scale thus arrived at and the previously measured physical scale of billboard density. The initial analysis looked at the entire

TABLE 11. TEST STATISTICS FOR SUCCESSIVE CATEGORIES SCALING ANALYSIS OF BILLBOARD DENSITY.

Test Statistic	All Participants	Age			Family Income ($/year)		
		<35	35-50	>50	<10,000	10-15,000	>15,000
$\bar{\Delta}$	0.01629	0.02463	0.02256	0.02346	0.0268	0.01663	0.02203
χ^{2*}	188.20	131.52	74.60	142.26	154.73	60.53	72.25
Bartlett's χ^{2**}	12.81	8.31	8.36	22.25	11.12	16.23	10.24

Number of Cars†			Education§			Number of Miles Driven/year			
1	2	3 (+)	non-grads	grads	post-grads	<10,000	10-20,000	20-30,000	>30,000
0.02445	0.01597	0.03304	0.02907	0.02091	0.02171	0.02835	0.01983	0.02442	0.02270
134.88	88.44	71.42	143.39	61.51	90.69	64.44	122.48	67.67	49.08
12.49	11.41	17.10	15.81	7.86	9.87	14.50	18.92	12.14	15.76

Gasoline Brands¶		Number of Credit Cards				
Yes	No	0	1	2	3	4 (+)
0.01730	0.02025	0.02153	0.03584	0.02500	0.03466	0.02110
151.13	59.21	56.90	144.15	58.16	85.68	55.29
13.59	8.39	14.09	21.07	7.00	18.58	7.55

NOTES:

* degrees of freedom = 170
** degrees of freedom = 8
† less than 1.0% had no car and are grouped with those with 1 car
§ grouped by college graduation
¶ response to question about regular use of same brand of gasoline

group of participants in an attempt to fit some possible expression to this relationship between the two scales. In the discussion of the theory the point was made that the psychological scale established by this procedure should be an interval scale and, as the scale of billboard density also possesses the properties of an interval scale, the relationship between the two scales should be unidimensional and linear regression should account for most of the variance and give the best fit with the data. Linear regression was used and multiple regression analysis tried, but it proved impossible to obtain a statistically better fit to the data than that yielded by linear regression between the two scales. As this was the initial conceptual model, the results indicate a high degree of success in arriving at a satisfactory scale for measuring the aesthetics of billboard density. The analysis was performed for the entire group and for several subgroupings as previously described. The resulting equations express the relationship found between the two scales, these are given in Table 12, along with the correlation coefficients and the scale values of billboard density related to indifference. These relationships are also illustrated in Figures 5, 6, 7, 8, 9, 10, 11 and 12.

An attempt was made at scaling and regression analysis using all of the original data rather than discarding a few unsatisfactory stimuli; the scale values were adjusted for unequal dispersions and the resulting correlation coefficient was 0.8332. This is another illustration of the improvement in the scaling brought about by eliminating the unsatisfactory stimuli. While the correlation was much lower, the characteristic value on the density scale at indifference was very similar to that found for the corrected case.

TABLE 12. REGRESSION ANALYSIS AND CORRELATION STATISTICS FOR THE RELATIONSHIP BETWEEN PSYCHOLOGICAL SCALE VALUES AND BILLBOARD DENSITY.

GROUPξ	SUBGROUPξ	REGRESSION EQUATIONϕ	CORRELATION COEFFICIENT	CHARACTERISTIC VALUEψ
All Participants		6.20367 - 0.72245dζ	0.9588	8.6
Age	<35	5.73762 - 0.66412d	0.9507	8.6
	35-50	7.74288 - 0.71750d	0.9556	10.7
	>50	4.54534 - 0.68171d	0.9429	6.7
Income	<10,000	6.84672 - 0.68968d	0.9573	9.9
	10-15,000	5.76588 - 0.71309d	0.9372	8.1
	>15,000	4.90443 - 0.69056d	0.9488	7.1
Cars	1	5.09384 - 0.66412d	0.9470	7.7
	2	6.53333 - 0.74122d	0.9455	8.8
	3 (+)	6.45501 - 0.65891d	0.9566	9.8
Education	non-grad	8.70409 - 0.83834d	0.9488	10.4
	grad	5.45998 - 0.61887d	0.9516	8.8
	post-grad	5.01585 - 0.67258d	0.9474	7.5
Miles Driven	<10,000	8.49875 - 0.80252d	0.9494	10.6
	10-20,000	4.84199 - 0.62841d	0.9362	7.7
	20-30,000	5.67127 - 0.71879d	0.9463	7.9
	>30,000	8.11912 - 0.81556d	0.9679	10.0
Gasoline Brands	Yes	5.68363 - 0.74479d	0.9587	7.6
	No	6.60835 - 0.64667d	0.9619	10.2
Credit Cards	0	5.74141 - 0.74888d	0.9534	7.7
	1	5.94054 - 0.64752d	0.9559	9.2
	2	7.16185 - 0.67436d	0.9226	10.6
	3	4.36334 - 0.60808d	0.9537	7.2
	4 (+)	6.54638 - 0.72739d	0.9630	9.0

NOTES:
ξ Groups and Subgroups are the same as in Table
ϕ Psychological Scale values are found from this equation
ζ d = billboard density in billboards per mile
ψ billboard density corresponding to indifference on the psychological scale

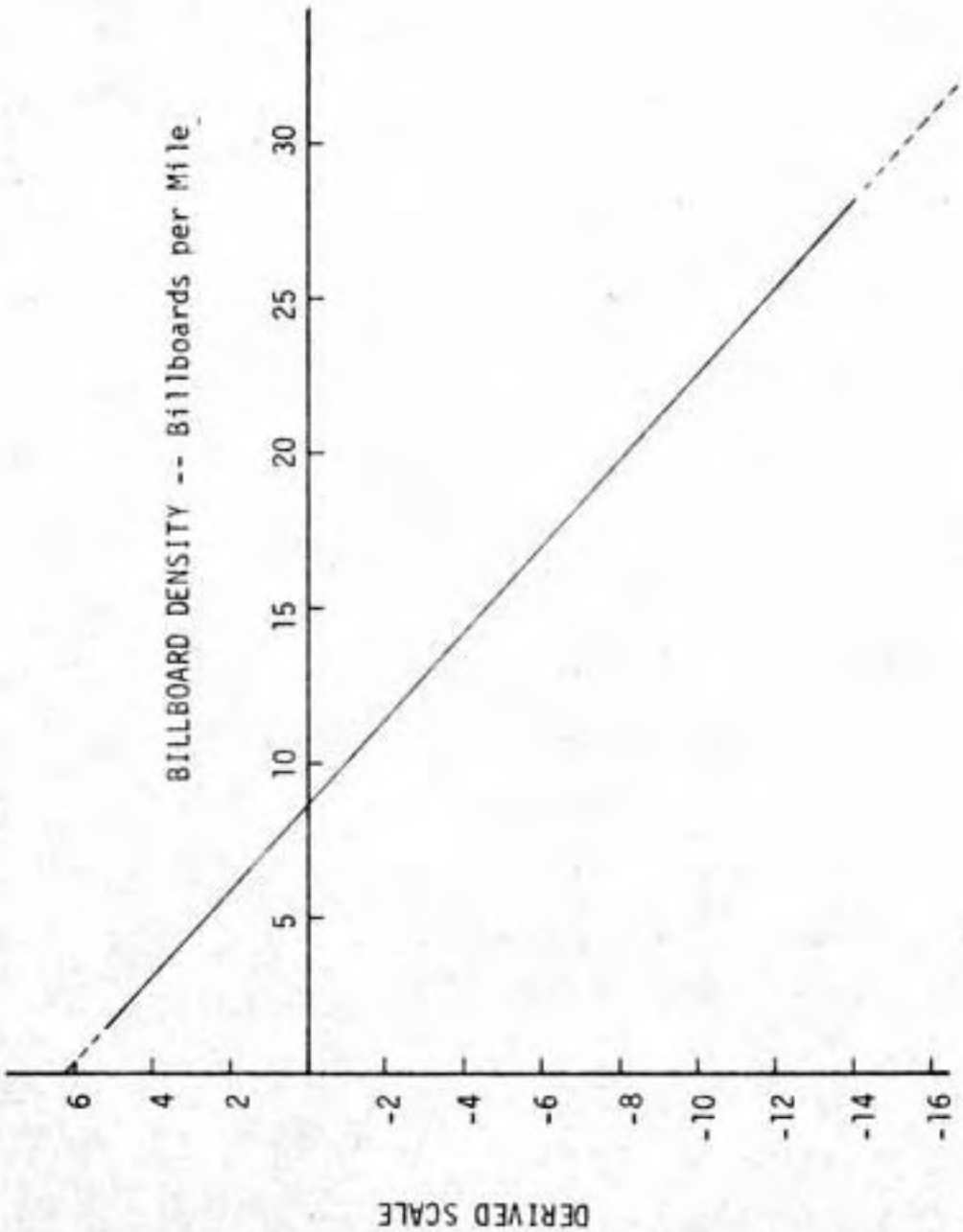


FIGURE 5. SCALE VALUES FOR BILLBOARD DENSITY -- ALL PARTICIPANTS.

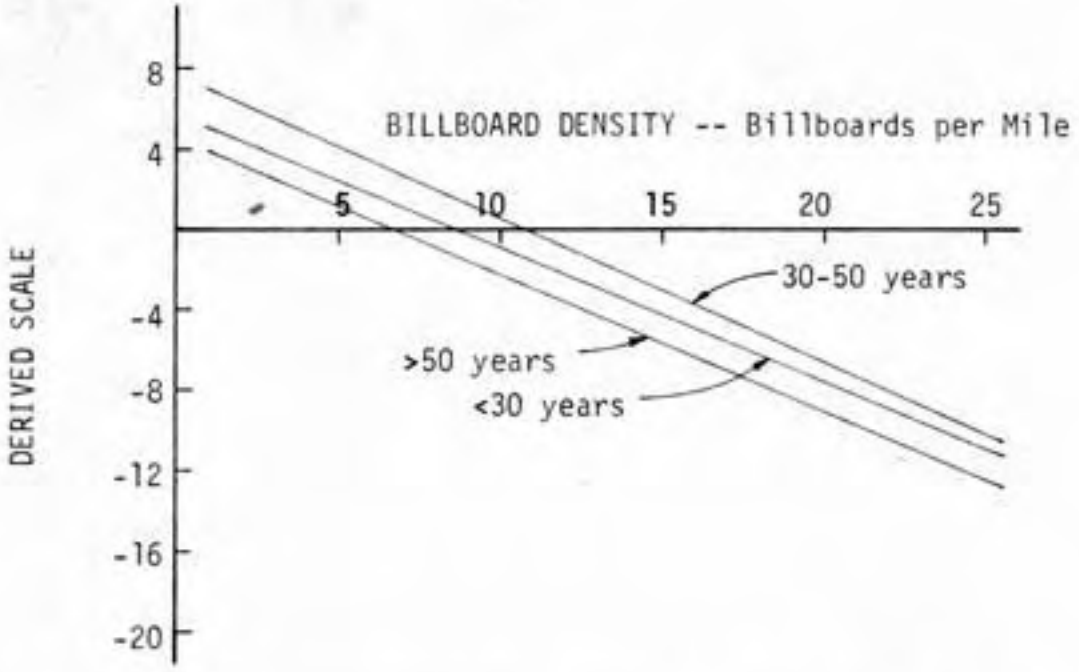


FIGURE 6. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY AGE OF PARTICIPANTS.

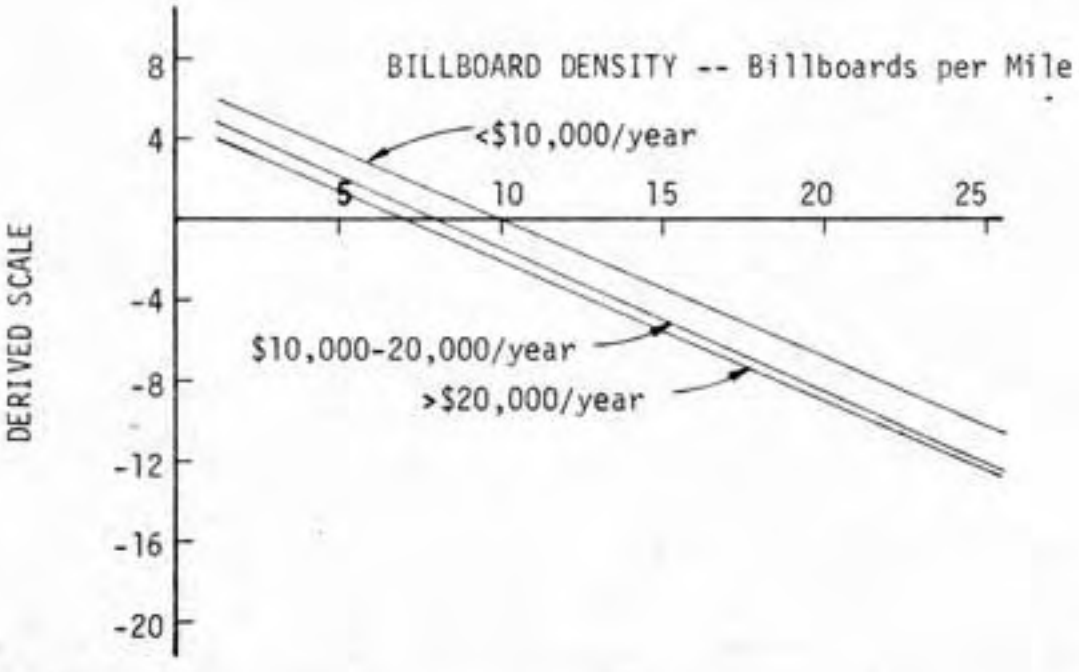


FIGURE 7.. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY FAMILY INCOME OF PARTICIPANTS.

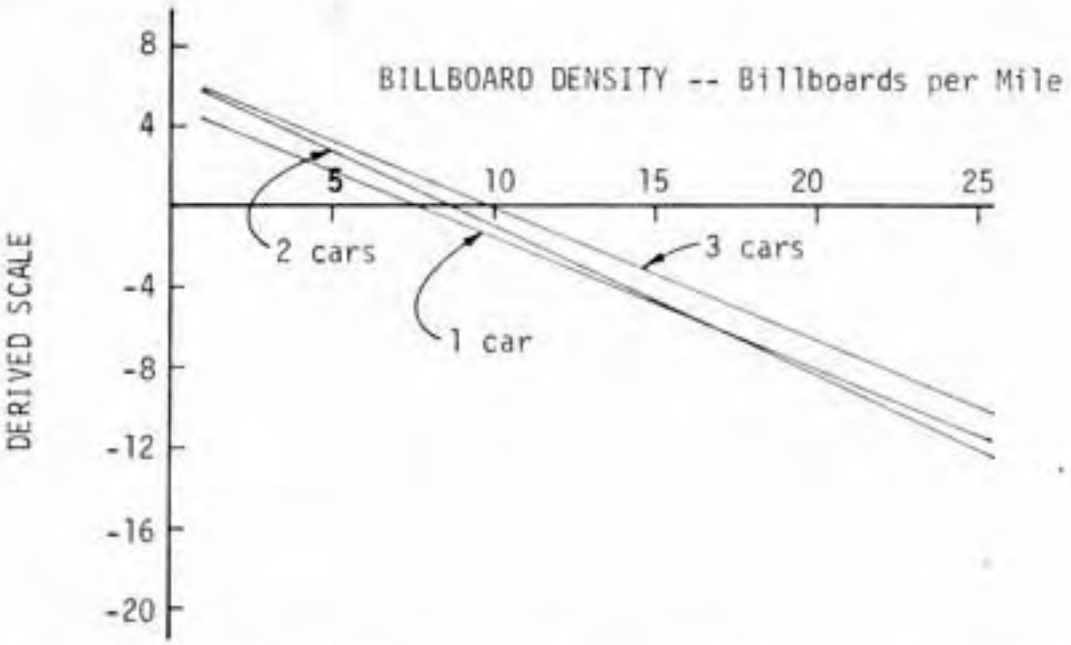


FIGURE 8. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY NUMBER OF CARS OWNED.

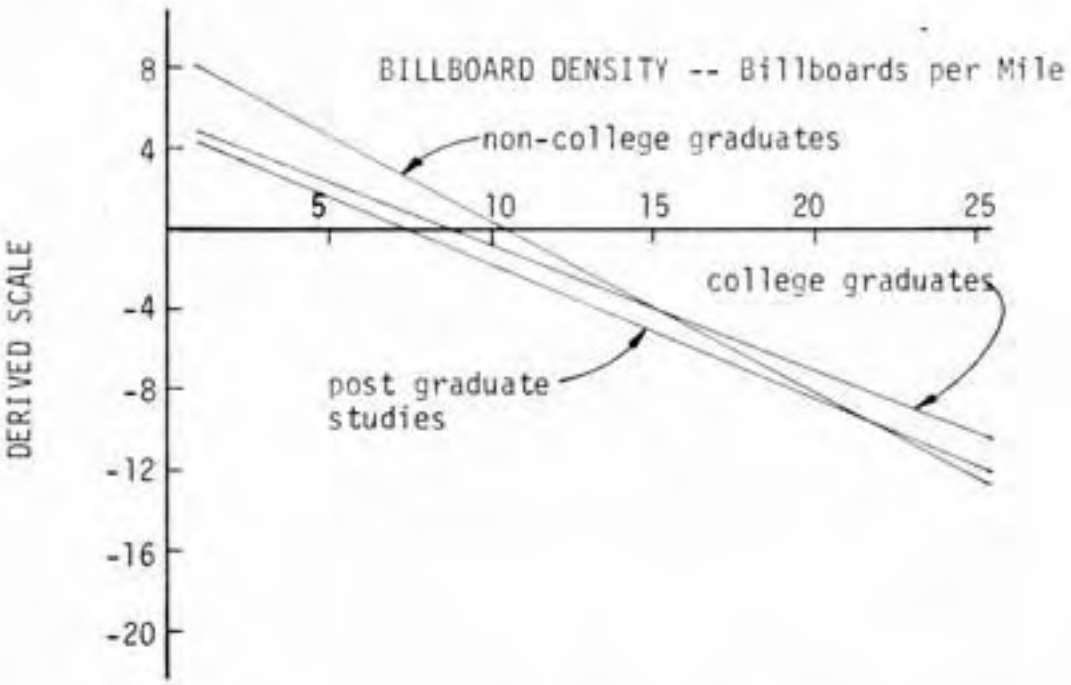


FIGURE 9. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY EDUCATION OF PARTICIPANTS.

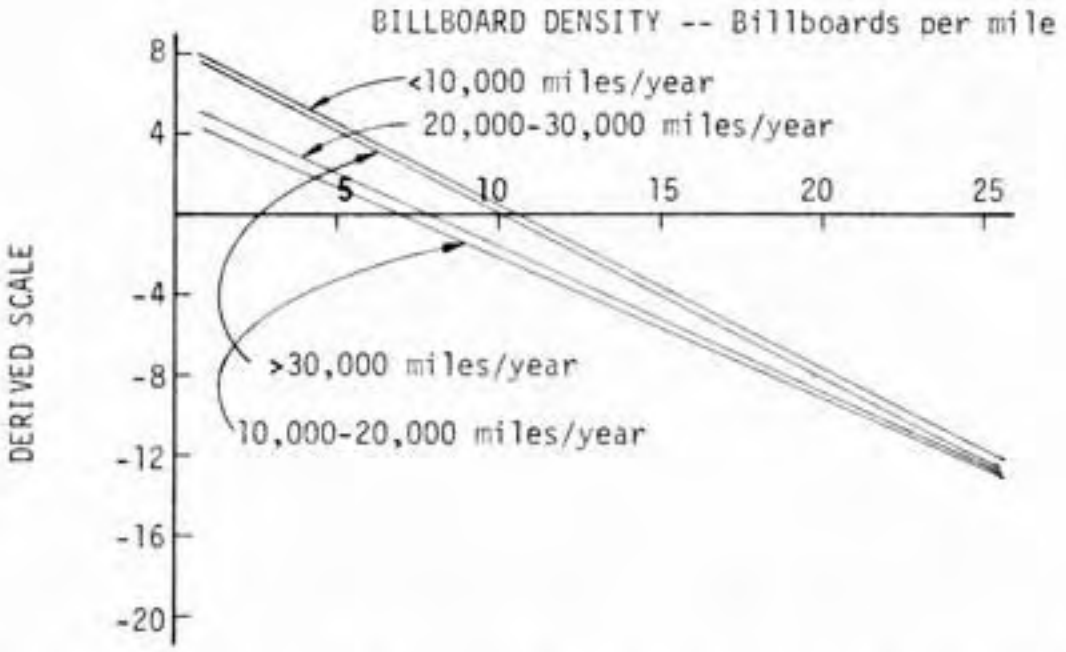


FIGURE 10. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY ANNUAL NUMBER OF MILES DRIVEN.

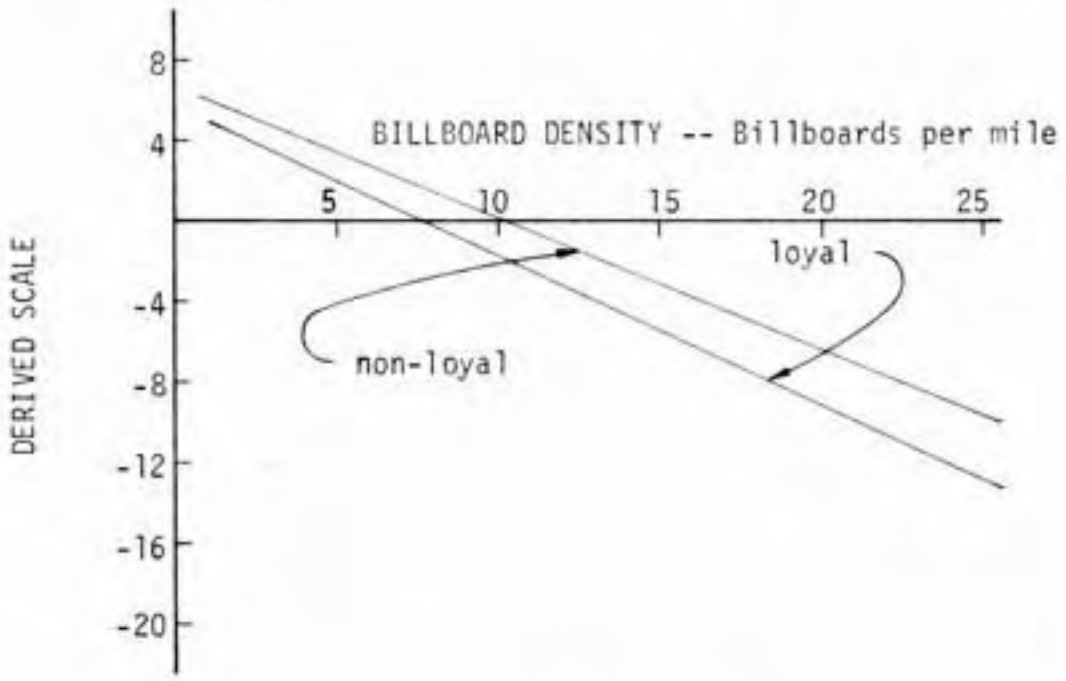


FIGURE 11. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY GASOLINE BRAND LOYALITY.

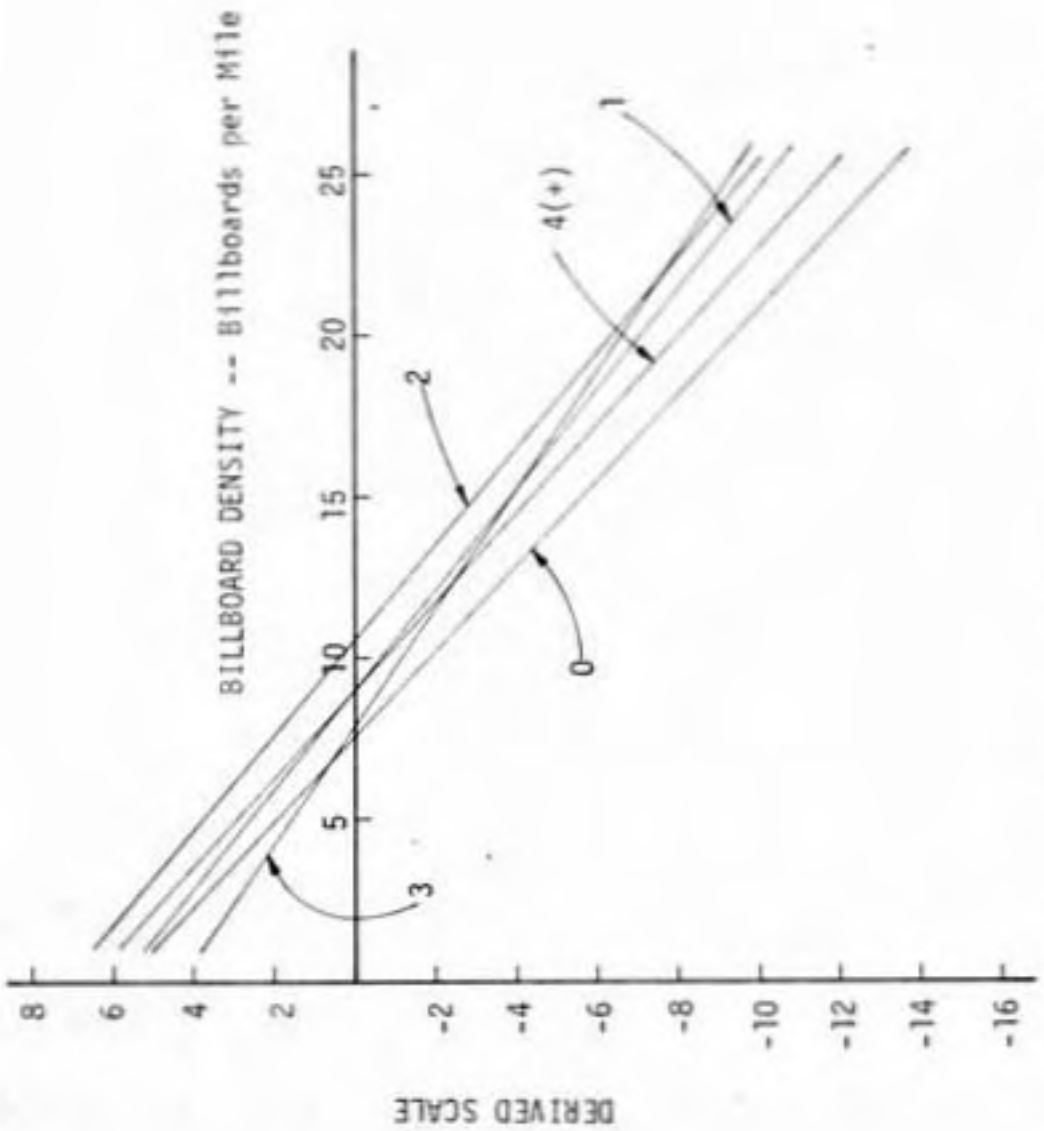


FIGURE 12. SCALE VALUES FOR BILLBOARD DENSITY -- GROUPING BY NUMBER OF GASOLINE CREDIT CARDS HELD.

Analysis of Questionnaire Responses

In addition to indicateing his responses to the films, each individual was asked to provide some information about himself and also to indicate his opinion on several subjects. The socio-economic information related to each participant was used as the basis for subgroupings in the analysis of response data for the films. The age distribution of the participants is shown in Figure 13, the family income distribution in Figure 14, the distribution of the number of cars owned by the participants in Figure 15, the education level of the participants in Figure 16, the number of gasoline credit cards held in Figure 17, and the number of miles driven per year by the participants in Figure 18. Additionally, 90.7 percent of the participants were male and 9.3 percent were female; 96.5 percent held a valid driver's liscense and 3.5 percent did not.

The participants provided the information in Table 13 when asked to list both industry and occupation for themselves; the codes are those as previously listed.

The average (median) respondent made 10 business and 6 pleasure trips per year, greater than 100 miles in length, and drove an average of 15,000 miles per year; he also had an average vacation of 15 days.

Participants indicated they generally use the same brand of gasoline as 70.0 percent said they did, 27.2 percent said they did not and 2.8 percent did not answer the question. However, they were about evenly divided on the question of prior reservations with 45.2 percent making prior reservations and 51.4 percent not doing so, 3.4 percent failed to answer this question.

In addition, several correlations were examined for the responses

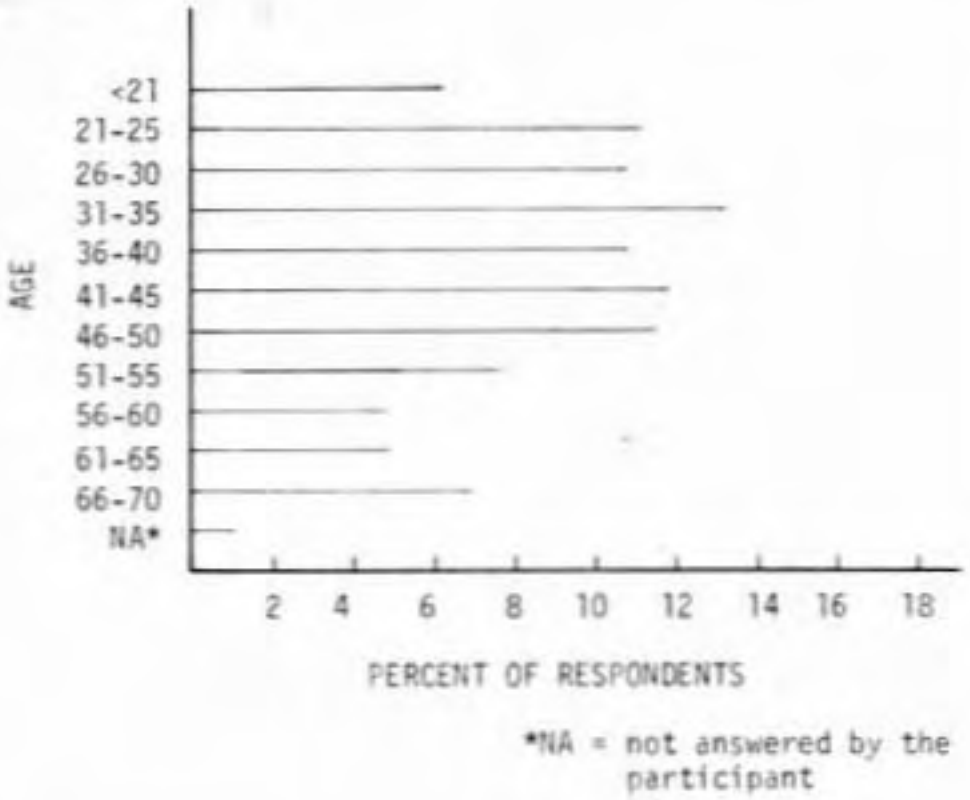


FIGURE 13. AGE DISTRIBUTION OF PARTICIPANTS.

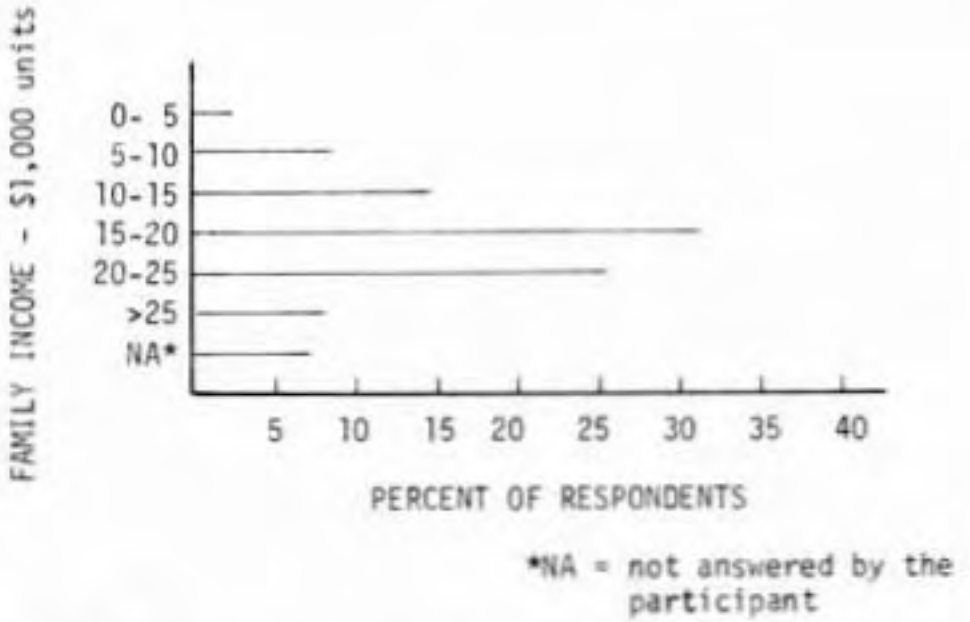


FIGURE 14. FAMILY INCOME DISTRIBUTION OF PARTICIPANTS.

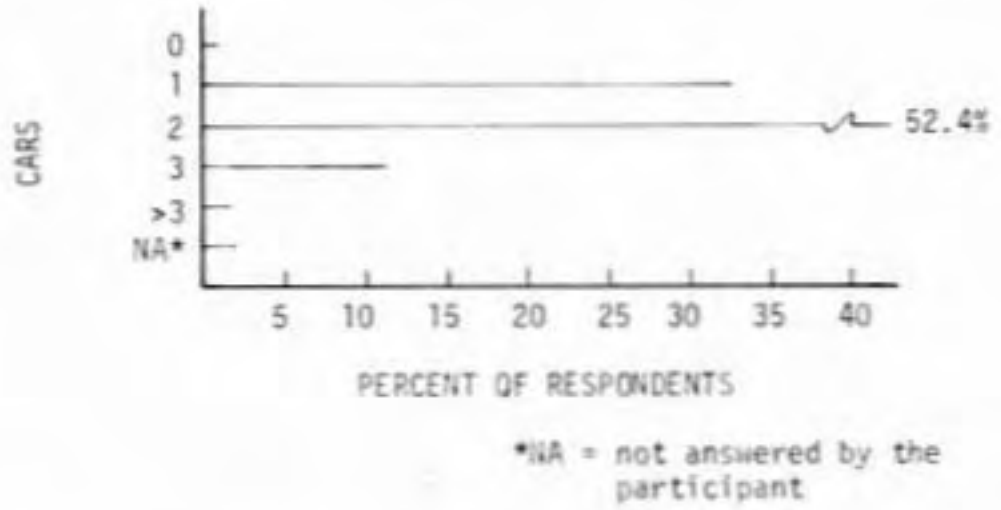


FIGURE 15. DISTRIBUTION OF THE NUMBER OF CARS OWNED BY PARTICIPANTS.

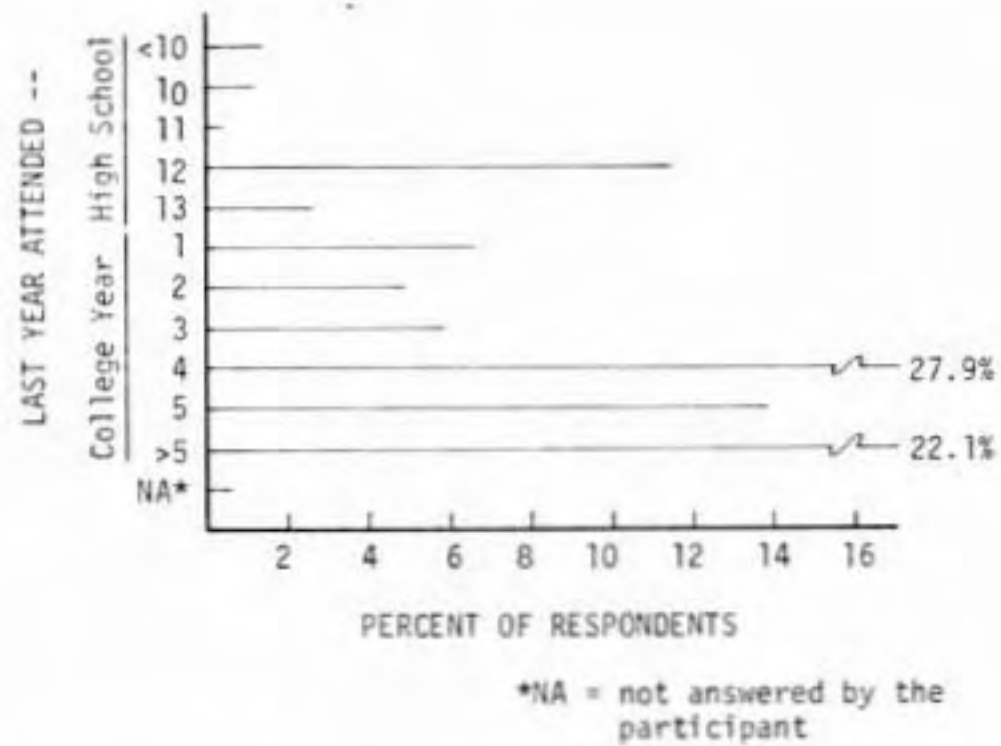


FIGURE 16. DISTRIBUTION OF EDUCATION OF PARTICIPANTS.

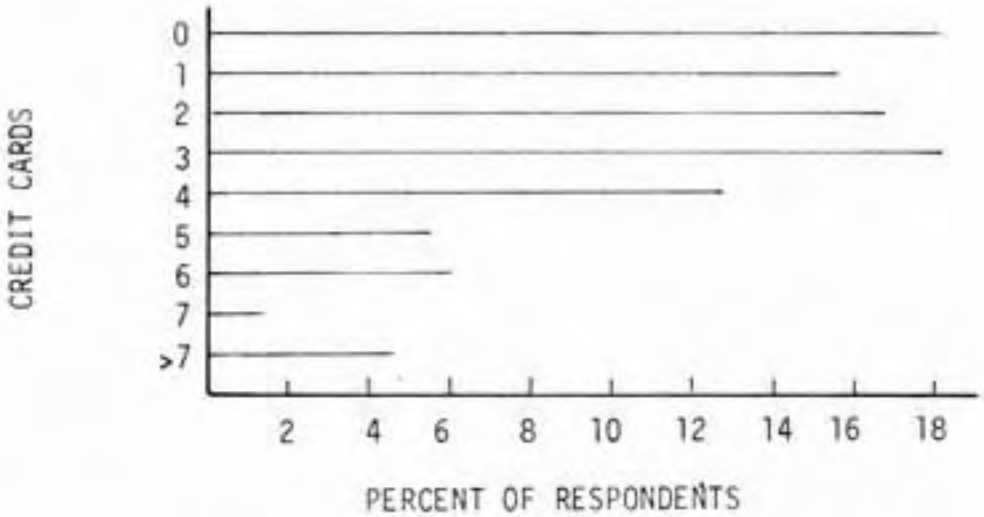


FIGURE 17. DISTRIBUTION OF GASOLINE CREDIT CARDS HELD BY PARTICIPANTS.

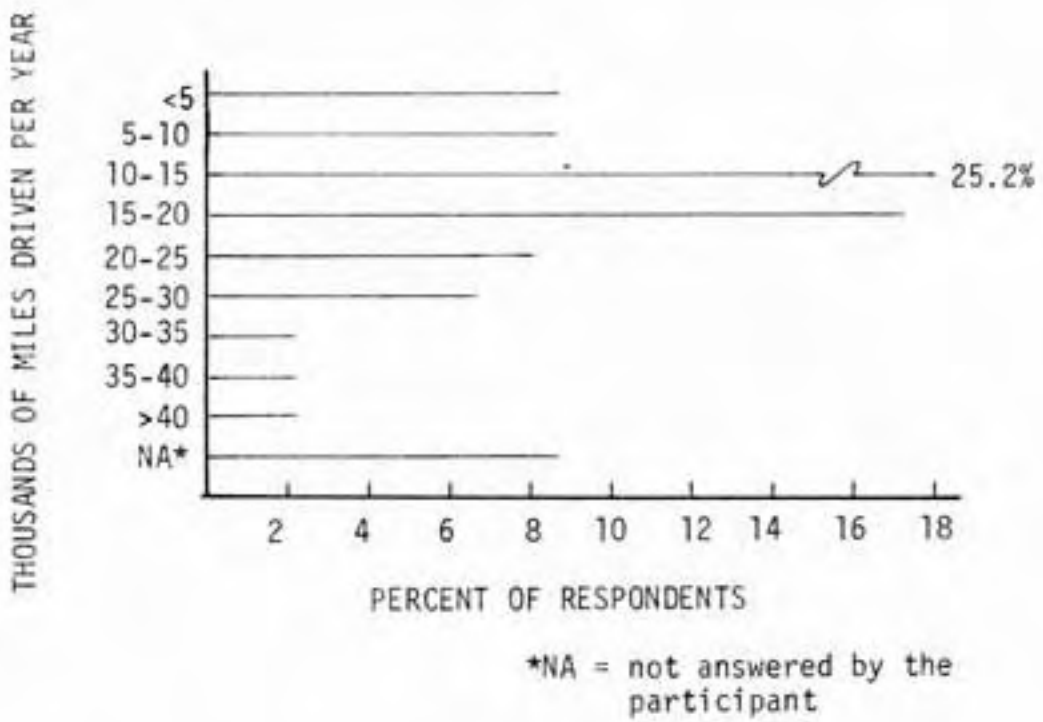


FIGURE 18. DISTRIBUTION OF THE ANNUAL NUMBER OF MILES DRIVEN BY THE PARTICIPANTS.

TABLE 13. INDUSTRY AND OCCUPATION DISTRIBUTION OF PARTICIPANTS.

Industry		Occupation	
Code*	Percent of Respondents	Code*	Percent of Respondents
0	11.0	0	49.3
1	5.5	1	0.7
2	20.7	2	24.1
3	0.3	3	1.4
4	6.2	4	4.5
5	2.1	5	0.3
6	48.3	6	0.0
7	0.0	7	0.0
8	3.1	8	0.7
9	2.8	9	0.3
		10	4.1
		11	6.6
		12	0.0
		13	4.5
		14	3.5
		15	0.0

* Code descriptions as contained in report text

from this phase of the project. These are summarized in Figures 19, 20, 21, 22, 23, 24, 25, 26 and 27. These respresent only the averages for each cross classification, the range of variability is not indicated.

The participants were asked to indicate the order of importance of several itmes they might depend upon for the purpose of locating services for meals and accomodations. The rankings given these are presented in Tables 14 and 15. They were also asked to indicate their preference regarding type of meal service for each meal and replied as shown in Figure 28. When asked how much money they preferred to spend for meals the participants responded as shown in Figure 29. While, when asked how much they expected to spend for accommodations, for a single room, they responded as shown in Figure 30.

When asked what their preferences were for conveniences or facilities at roadside rest areas, the participants replied as shown in Table 16. When asked what type of highway signing they preferred as an aid in locating services the participants replied as shown in Table 17, with 10.7 percent of the participants failing to answer the question. The participants were asked to rand a number of sources of possible annoyance to them (when driving), the list consisted of:

confusing or inadequate signs,
billboards along the highway,
lack of services along the freeways,
unclean restrooms,
traffic,
inept or incompetent drivers;

the replies to this question are shown in Figure 31.

Each individual was also given a list of statements of opinion on several matters relating to both billboards and junkyards and asked to indicate which, if any, he agreed with. In Table 18 the statements are

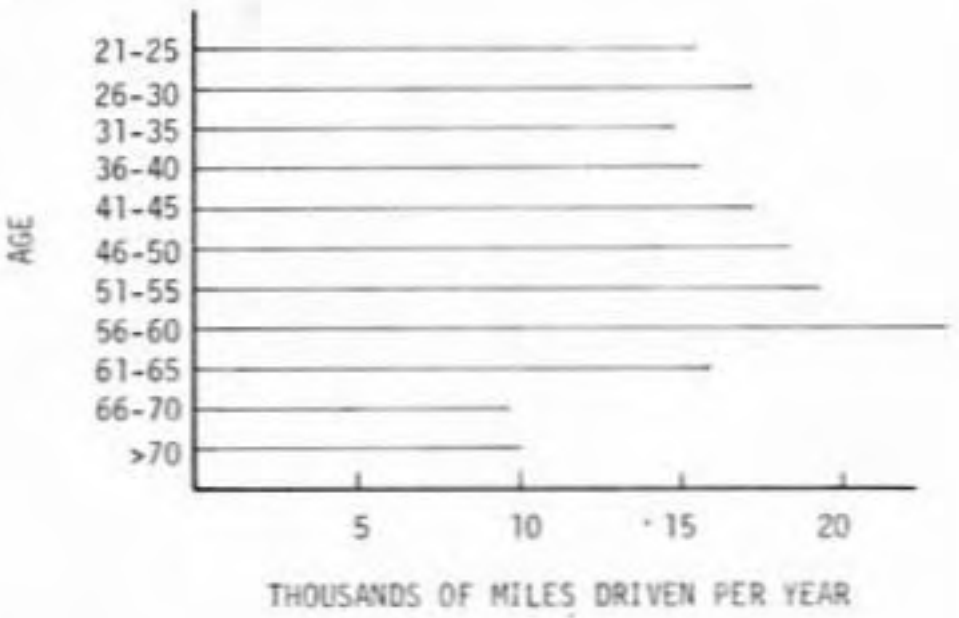


FIGURE 19. AGE VS AVERAGE ANNUAL NUMBER OF MILES DRIVEN.

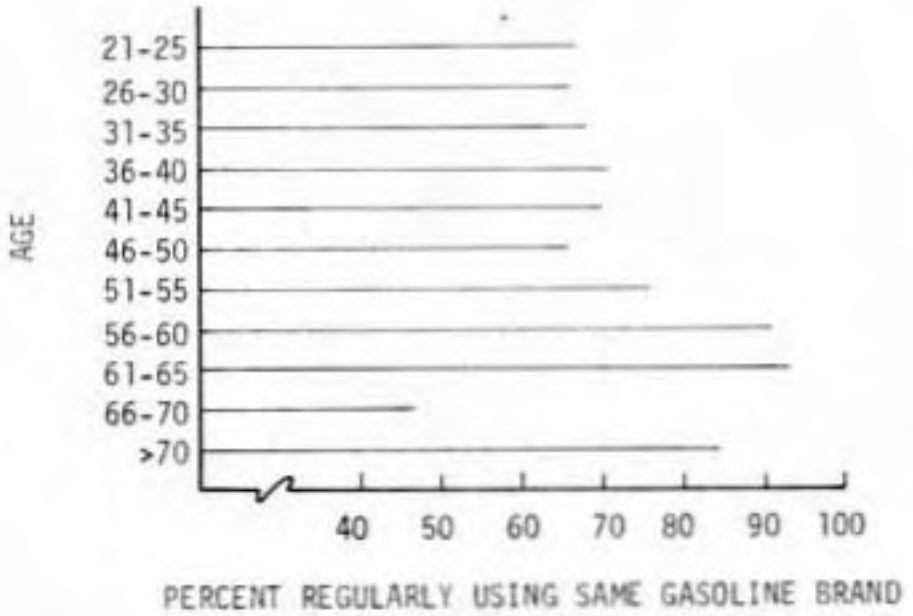


FIGURE 20. AGE VS GASOLINE BRAND LOYALITY.

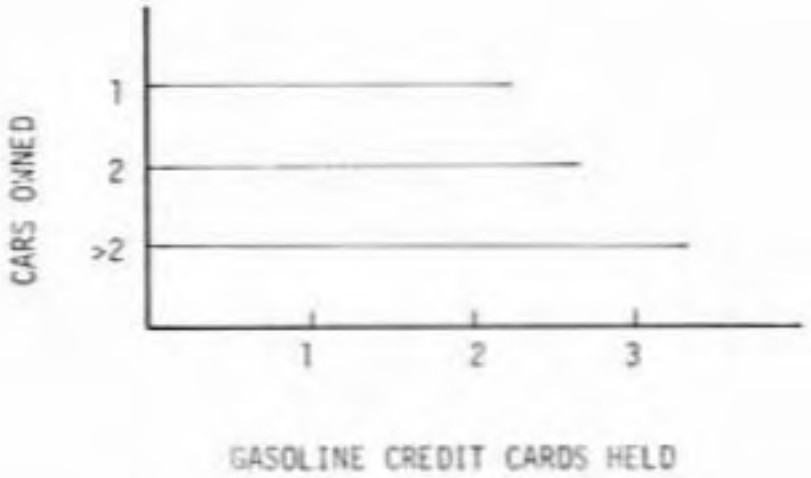


FIGURE 21. CARS OWNED VS AVERAGE NUMBER OF GASOLINE CREDIT CARDS.

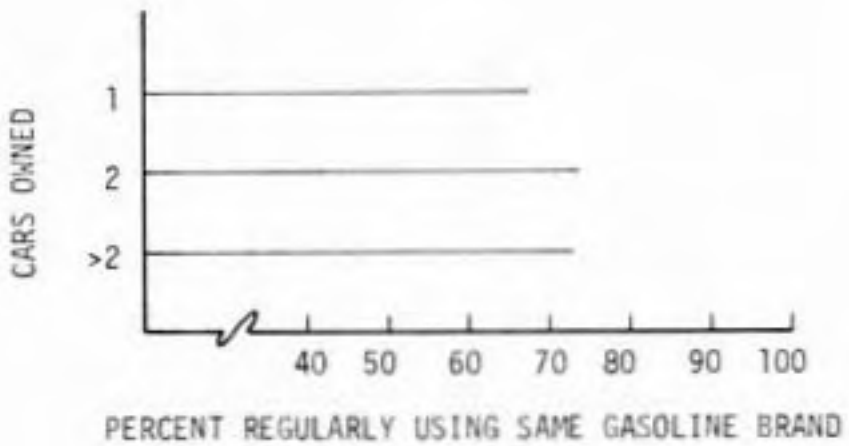


FIGURE 22. CARS OWNED VS GASOLINE BRAND LOYALITY.

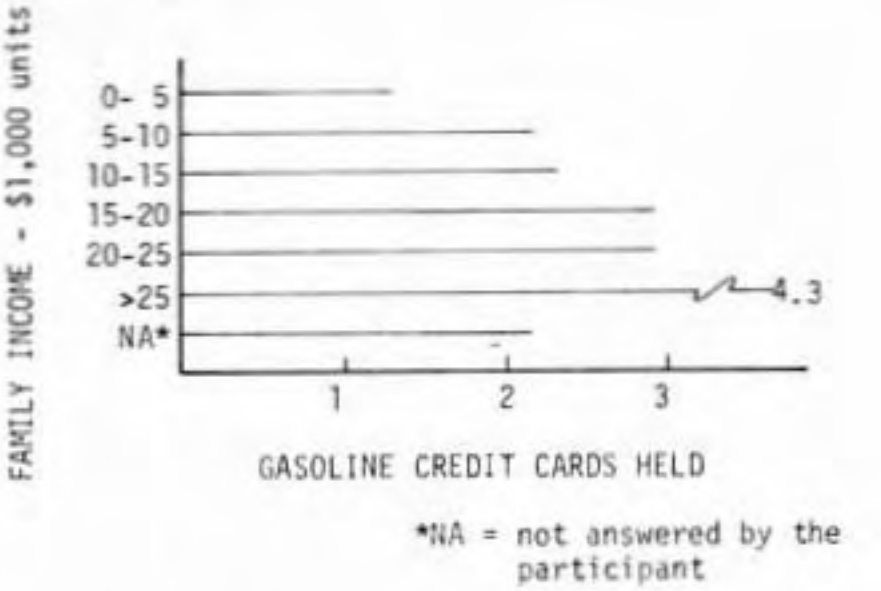


FIGURE 23. FAMILY INCOME VS AVERAGE NUMBER OF GASOLINE CREDIT CARDS.

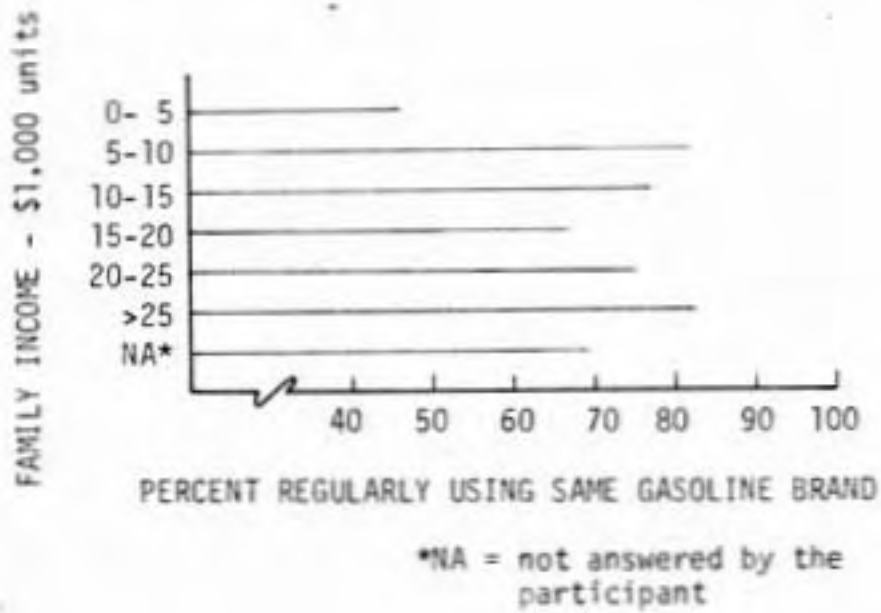


FIGURE 24. FAMILY INCOME VS GASOLINE BRAND LOYALITY.

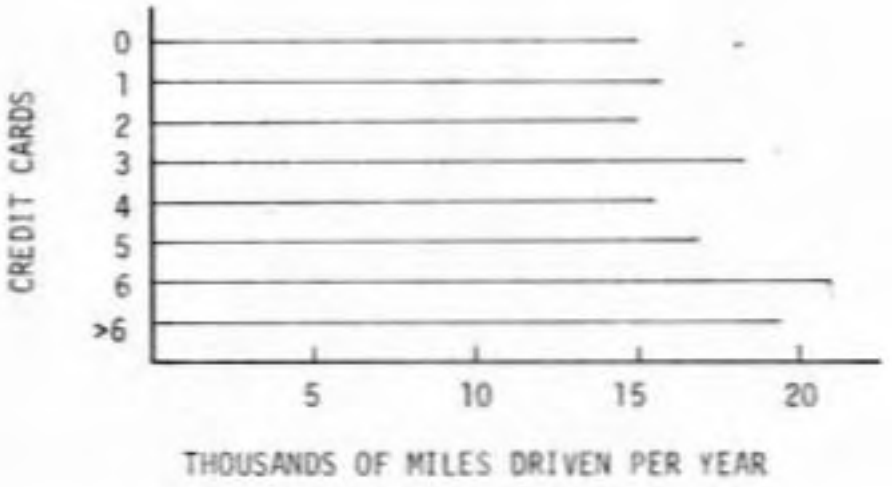


FIGURE 25. GASOLINE CREDIT CARDS HELD VS AVERAGE ANNUAL NUMBER OF MILES DRIVEN.

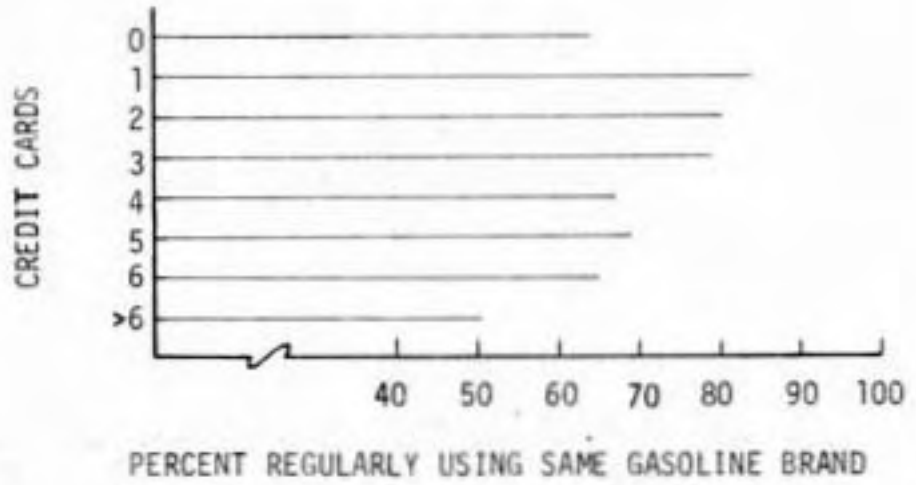


FIGURE 26. GASOLINE CREDIT CARDS HELD VS GASOLINE BRAND LOYALITY.

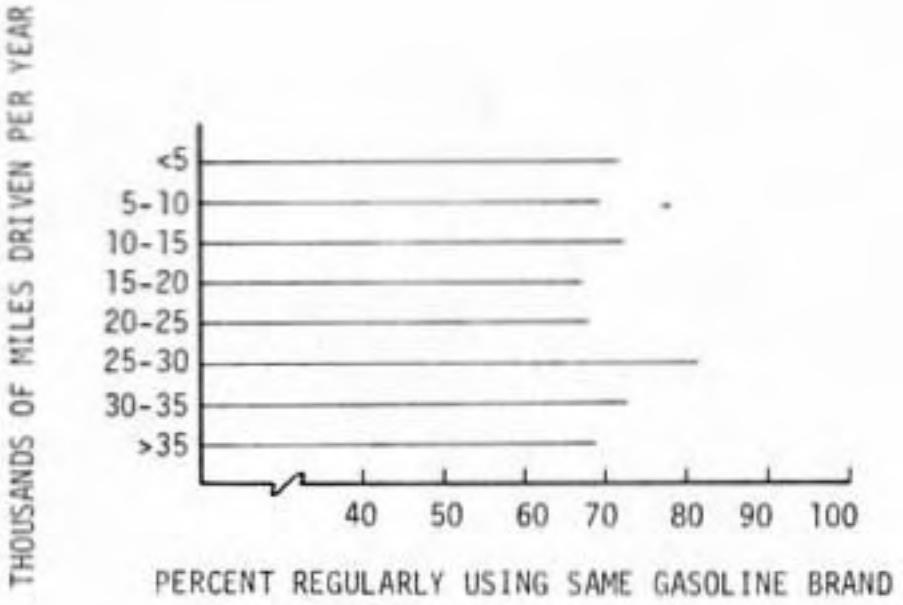


FIGURE 27. AVERAGE ANNUAL NUMBER OF MILES DRIVEN VS GASOLINE BRAND LOYALITY.

TABLE 14. RANK ORDER OF IMPORTANCE OF SOURCES OF AID FOR LOCATING A PLACE TO HAVE A MEAL.

Rank Order*	Credit Cards Honored			National Advertising			Recommended by Someone			Price			Billboards			Appearance (outside)		
	B	L	D	B	L	D	B	L	D	B	L	D	B	L	D	B	L	D
1	3	4	10	6	5	5	21	27	42	17	11	12	4	5	5	145	133	120
2	7	10	11	11	10	9	33	36	41	49	39	39	5	7	6	42	42	41
3	8	6	10	21	22	18	36	33	33	26	34	29	8	6	8	27	22	33
4	7	4	7	5	7	7	17	18	17	9	9	10	12	11	11	13	15	12
5	4	7	10	8	10	9	6	3	7	2	1	6	4	4	4	2	1	1
6	2	1	3	9	8	10	2	2	2	3	4	6	6	6	5	1	0	1
7	3	3	4	2	3	4	2	1	0	6	6	7	5	5	4	1	1	1
8	6	7	7	4	1	2	1	0	0	1	1	1	4	4	5	0	0	1
9	23	22	22	17	18	18	17	17	17	21	21	21	21	20	20	17	17	17
NR**	227	226	206	207	206	208	155	153	131	156	164	159	221	222	222	42	59	63

Rank Order*	Repeat Visit			Chain Affiliation			Guide Book Recommendation			Other		
	B	L	D	B	L	D	B	L	D	B	L	D
1	26	31	26	23	24	23	15	15	18	5	5	3
2	43	39	44	30	32	23	14	14	19	3	3	4
3	26	30	28	33	28	25	19	23	26	1	2	1
4	14	15	19	5	8	12	12	13	11	0	0	0
5	5	4	5	8	9	11	7	9	11	0	0	0
6	1	2	2	4	1	2	1	2	2	0	0	0
7	1	1	2	2	2	3	2	0	1	0	0	0
8	0	0	0	3	4	2	4	4	5	0	0	0
9	21	20	20	17	17	18	21	22	21	18	17	18
NR**	153	148	144	165	165	171	195	188	176	263	263	264

B = breakfast
L = lunch
D = dinner

* as rated by the number of participants indicated

** number of participants who did not rate this part of the question

TABLE 15. RANK ORDER OF IMPORTANCE OF SOURCES OF AID FOR LOCATING ACCOMMODATIONS.

Rank Order*	Credit Cards Honored		National Advertising		Recommended by Someone		Price		Billboards		Appearance (outside)	
	B	P	B	P	B	P	B	P	B	P	B	P
1	30	23	8	11	25	22	18	23	4	6	82	89
2	18	19	18	10	28	32	46	56	5	7	37	53
3	22	24	14	16	28	28	22	32	4	5	37	39
4	6	10	8	7	19	16	13	12	3	4	18	17
5	7	7	4	6	6	6	5	7	5	7	4	2
6	2	3	3	6	7	6	2	2	4	1	0	2
7	3	2	5	6	0	1	4	3	3	3	2	1
8	4	5	0	0	1	0	3	2	3	4	1	0
9	17	18	15	15	13	13	14	14	18	20	14	13
NR**	181	179	213	213	163	166	163	139	241	233	95	74

Rank Order*	Repeat Visit		Chain Affiliation		Guide Book Recommendation		Other	
	B	P	B	P	B	P	B	P
1	27	23	27	30	26	35	3	1
2	22	23	44	32	14	14	1	0
3	35	31	29	27	18	20	0	1
4	18	24	11	14	6	9	1	1
5	6	7	7	9	11	11	1	0
6	3	3	5	7	1	2	1	1
7	2	1	1	1	2	3	0	0
8	0	0	2	3	4	5	0	0
9	13	13	14	13	14	14	13	14
NR**	164	165	150	154	150	177	270	272

B = business trip purpose
P = pleasure trip purpose

* as rated by the number of participants indicated

** number of participants who did not rate this part of the question

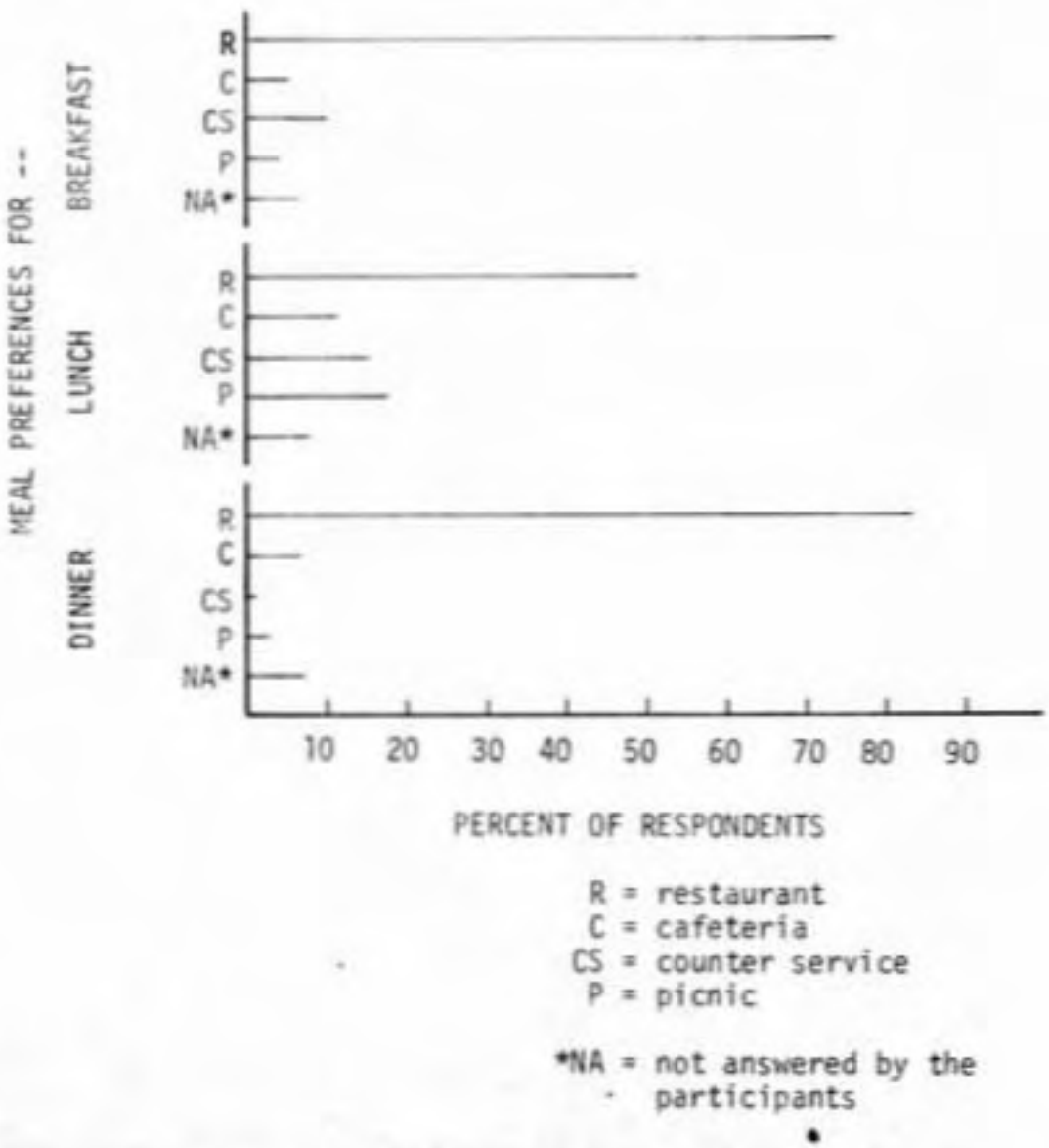


FIGURE 28. DISTRIBUTION OF PREFERENCES FOR TYPE OF MEAL SERVICE.

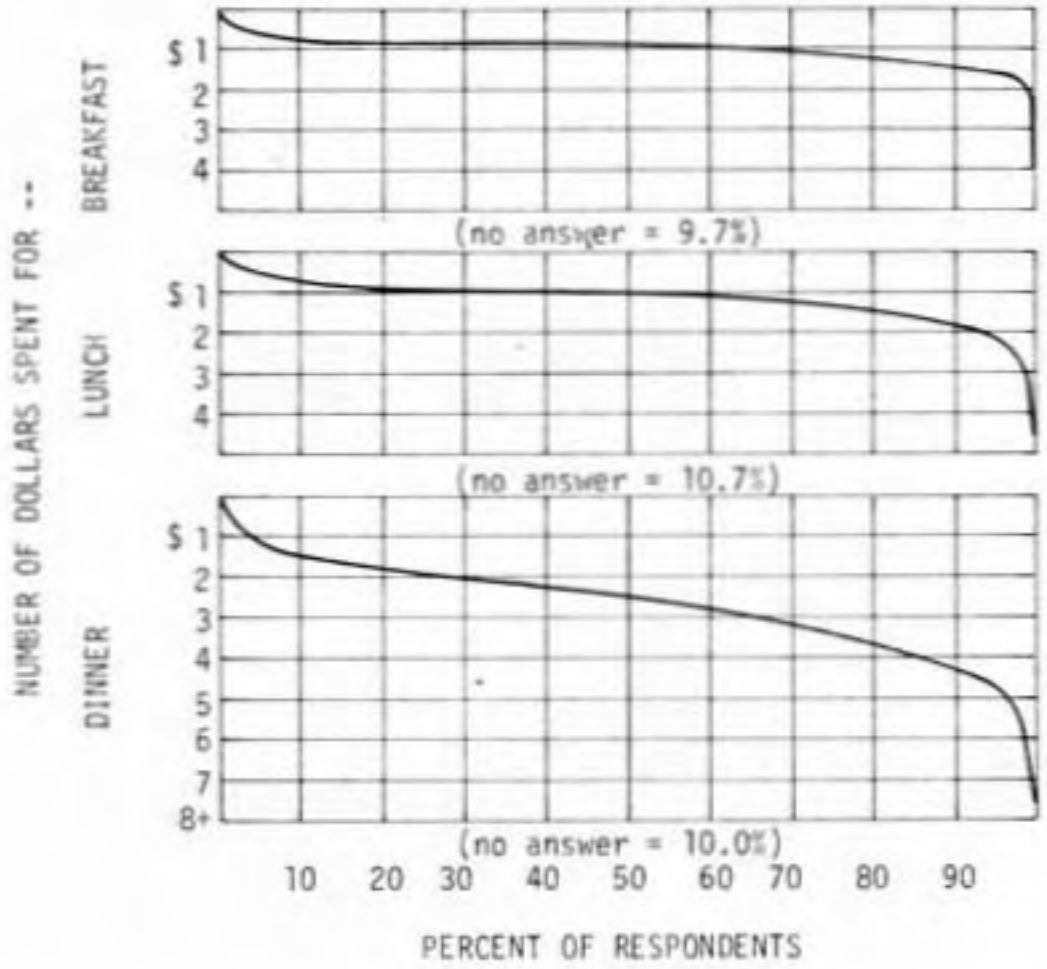


FIGURE 29. DISTRIBUTION OF MEAL EXPENDITURES BY PARTICIPANTS.

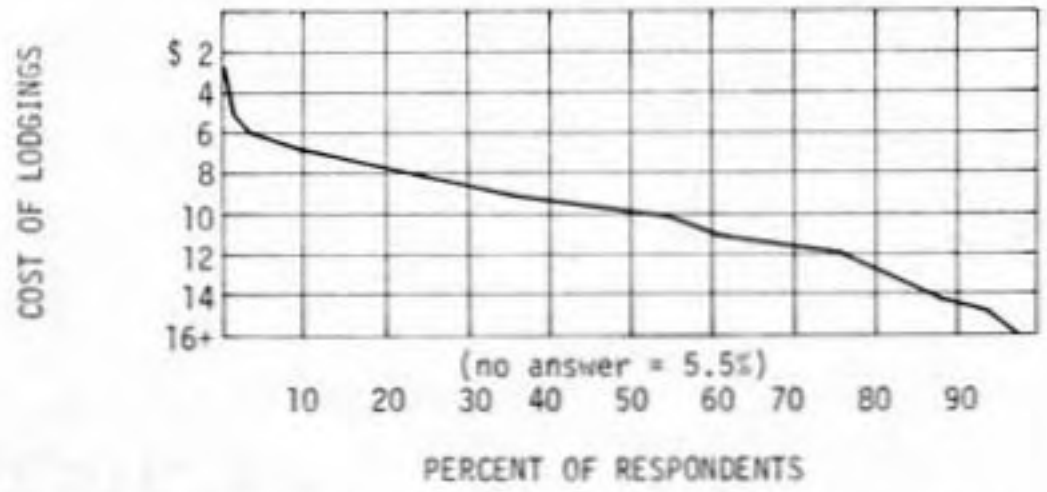


FIGURE 30. DISTRIBUTION OF LODGING EXPENDITURES BY PARTICIPANTS.

TABLE 16. PERCENT OF PARTICIPANTS DESIRING VARIOUS REST AREA CONVENIENCES.

Rest Area Conveniences	Percent of Participants Desiring Convenience	Rank
Telephone	70.3	3
Restrooms	95.1	1
Night lighting	62.1	4
Overnight camping space	24.1	7
Drinking water	92.1	2
Picnic tables	60.0	5
Information aids	52.1	6

TABLE 17. PREFERENCES FOR HIGHWAY SIGNING FOR SERVICES.

Type of Signing	Preferred by Percent of Participants
Notification of: "SERVICES," or "SERVICES THIS EXIT," or "ROADSIDE BUSINESS."	3.5
Notification of service type: "GAS," "FOOD," "PHONE," "LODGINGS."	32.7
Services by brand name: "Standard," "Shell," "Holiday Inn," "Howard Johnson."	45.2
Service availability: "GAS 1 mi.," "OPEN 24 Hours," "NEXT SERVICES 15 miles."	18.6

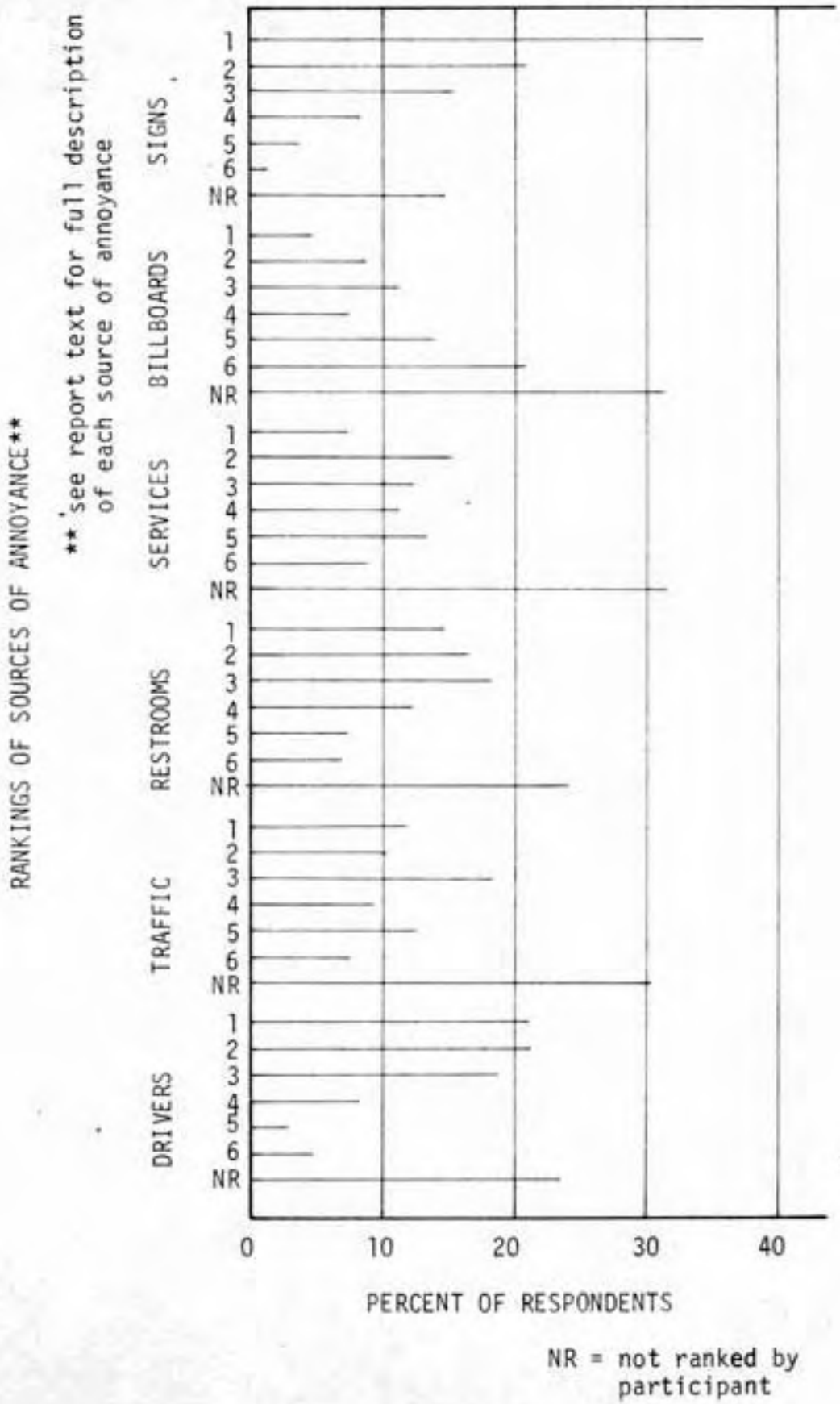


FIGURE 31. DISTRIBUTION OF RATINGS OF ANNOYANCES BY PARTICIPANTS.

TABLE 18. PERCENT OF PARTICIPANTS HOLDING CERTAIN OPINIONS.

Percent of Participants Checking Statement	Statement
26.3	Billboards are interesting along the highway
82.0	Junkyards are ugly sights along the highway
50.9	I rely on billboards to find services needed when traveling
76.5	Junkyards should be fenced in and planted so as to hide them from view from the road
13.8	All billboards should be removed from the roadside
19.0	I do not rely on billboards to find services needed when traveling
24.2	Billboards are ugly sights along the highway
19.0	Billboards should not be removed from the roadside
1.4	Junkyards are interesting sights along the highway
44.6	Billboards are necessary to provide information to the motorist
45.7	Junkyards should be removed from the roadside
64.0	Many billboards should be removed from the roadside
3.5	Junkyards should not be removed from the roadside
18.7	Billboards are not really needed to provide information to the motorist
2.8	Junkyards are not ugly sights along the highway

listed along with the percent of participants who indicated they agreed with each statement. An additional 6.2 percent of the participants did not agree with any single statement probably indicating they did not consider the question or omitted it for some reason.

CONCLUSIONS AND NEEDED RESEARCH

Participants

After studying the socio-economic information provided by the participants, it immediately becomes obvious that the participants do not adequately reflect a general cross section of the public. There is a definite lack of female participants. However, the major portion of the organizations contacted with a request to take part in the project were organizations that primarily involved women (eg. PTAs, Garden Clubs, Ladies Aid Societies, etc.). The response from these groups was so poor (only two replied, both in the negative) that it would seem to indicate some lack of interest or concern. Perhaps there would be no major difference in the results due to a larger inclusion of women. The number of women in the survey sample is so small that it prevented any separate analysis for possible comparisons or study by sex.

The educational background, the family income and the number of cars owned by the participants are all above the general population averages. This is partly to be expected due to the types of organizations which did participate in the project; they were predominately businessmen's groups and service clubs. This also accounts for some of the lack of variety in both the industry and occupation reports by the participants, although this is not far from a general cross section of public employment. Groups such as labor unions were contacted but failed to show any interest, making it extremely difficult to reach several segments of the population.

It appears, however, to be reasonable to assume the participants reflect, to a considerable extent, the general opinions of the public regarding the questions studied. The size of the group and its composition precludes any stronger statements, but the highly consistent responses and the trends found do seem logical and understandable.

Responses to the Films

The similarity in the results for the various subgroupings for the billboard film analysis indicates that a strong conceptual relationship probably exists although variations may be related to some group characteristics. The general trend for all participants is the same and is best shown by Figure 5, the results for the total group. From this it would seem that any increase in billboard density beyond a zero level leads to a decrease in appreciation of the aesthetics involved and thus likely to a reduction in driving pleasure. It would also seem that a density exists beyond which it is considered intolerable to go, that being the density corresponding to a zero on the psychological scale. This value varies from about 6.7 to 10.7 billboards per mile, with the average for all participants being 8.6.

Several relationships were also examined for the various subgroupings. When considering grouping by age, the participants in the age range 30 to 50 did not object as strongly to billboards as did those both younger and older, as was indicated by their characteristic value on the billboard scale which was not as low as for those outside this age range. (The characteristic value referred to is the billboard density corresponding to a zero value on the psychological scale.) This may indicate more acceptance due to more exposure than the younger

participants and less concern than the older participants -- it may also indicate a greater degree of use made of the information contained on billboards.

There seems to be a decreasing acceptance of billboards with increasing family income and with increasing education; this may reflect an improved cultural background.

An increase in acceptance of billboards seems to be related to an increase in the number of cars owned, possibly reflecting more exposure and conditioning to billboards. There is also an increase in acceptance of billboards related to an increase in the number of miles driven per year, with the exception that those driving very little exhibit the greatest acceptance! This may also reflect the effect of exposure and conditioning while the high acceptance by low mileage drivers may reflect lack of experience with the situation.

Participants who held either many gasoline credit cards or none at all objected more strongly to billboards than those who held a few such credit cards. This probably indicates the relative needs and desires for brand name information and service location information by the participants, with those most dependent upon a few brands demanding better and more information due to their limited shopping desires!

The pattern of responses to the junkyard screening film did not result in a very strong relationship between the physical and psychological scales as is indicated by the low correlation coefficient. An attempt to relate variances in the response pattern to subgroup characteristics proved unsuccessful. However, a qualitative trend for the entire group may be seen even though the quantative measurement of it is

none to good. It is apparent from Figure 4 that increases in screening lead to increases in the psychological scale values (all scale values are negative). The affect of shortcomings in the stimuli used (previously discussed) may be seen here as there is no completely systematic increase in scale value with an increase in screening. However, it is interesting to note that the extension of the linear regression line to the 100 percent screening level gives a corresponding psychological scale value of almost exactly zero! From this trend and zero intercept it seems that any obvious presence or evidence of a junkyard is undesirable and that the greater its obvious presence (less screening) the more unacceptable it becomes. This is the most that can be said based upon this information. The experiment would have been more successful if the stimuli had been better but the only certain way to perform such a study would be to vary the degree of screening of one particular junkyard and study just that one site. There is also no inference possible from this study concerning the effects of types of screening other than natural vegetation.

Responses to the Questionnaire

In addition to socio-economic information used for grouping purposes, several worthwhile other things were learned from, and about, the participants.

One popular opinion holds that billboards are needed as they are an important source of information about services desired by the public. However, when asked to rank several sources of aid used in locating accommodations and places to eat, the participants consistently omitted billboards from the list and those few who did rank billboards ranked

them last or second last -- far down the list from what was considered important. (This is more revealing when it is noted that the list suggested to the participants for ranking purposes did contain billboards.) Thus it would appear that billboards are not very important sources of information and it might be possible to replace their function completely with officially erected signs such as have been proposed. (One illustration of such a sign is found in Reference 44.)

Another popular opinion is that billboards are distracting and annoying but when asked to rank a number of sources of annoyance, the participants placed billboards last on the list -- one third did not even rank billboards at all. It would seem that people really are not concerned or simply do not care about billboards. In view of the biasing effect of having shown the film to the participants before they completed the questionnaire, it is even a stronger indication; if the participants had been concerned their responses would have been influenced by the exposure to the film and thus they would have been more likely to consider billboards in giving their responses.

One question which presented a number of opposing statements of opinion of several subjects had some interesting results. Approximately 26 percent of the participants thought billboards were interesting sights along the highway while 24 percent thought they were ugly sights. Some 51 percent indicated they used billboards as an aid in locating services while 19 percent said they did not; 44 percent thought billboards were necessary for providing information to motorists and 19 percent did not. Yet, 14 percent thought all billboards should be removed from the highway and 64 percent thought many billboards should be removed but only 19

percent disagreed and felt billboards should not be removed. This pattern seems to indicate similar results to the film study, i.e. billboards are generally undesirable.

The information gathered in this investigation presents a strong, logical case for control of billboards along the highway. From an aesthetic viewpoint billboards are undesirable but tolerable in small numbers. From other considerations they are useful but not nearly as important as has been claimed by some; neither are they as objectionable as some critics claim. This all seems to indicate a program of controls with a limited number of billboards permitted as the most rational and acceptable program to the public. This does not mean that a program of official signs could not replace virtually every billboard need and function satisfactorily -- this question remains largely unanswered.

The pattern of responses when considered with the results from the junkyard film section indicates a desire on the part of the public to have junkyards controlled as far as view is concerned. The responses to both sections on the topic of junkyards present a good case for a program of junkyard screening so as to eliminate the obvious presence of junkyards where possible; it also points to giving consideration to removing junkyards that it is not possible to screen.

Less than 2 percent of the participants indicated they thought junkyards were interesting sights along the highway while 82 percent disagreed, thinking they were ugly sights. Some 46 percent thought junkyards should be removed from the roadside and 77 percent felt they should at least be screened, (some duplication in responses to these two statements occurred accounting for a total of more than 100 percent) but

less than 4 percent felt junkyards should not be removed at all.

Thus it seems the responses to each section of this investigation indicate a desire for improvement in the view from the road, and in the quality of the roadside, by limiting and removing billboards and by screening or removing junkyards. It appears that the public wishes, and is ready to accept, provisions controlling both sources of aesthetic disturbance!

Other Responses

A few interesting conclusions may be drawn from the responses to some of the remaining questions asked of the participants. Several conveniences or facilities are desired by the public at roadside rest stops; the most highly rated of which is restroom facilities but almost equally important is drinking water. Then in decreasing order, but desired by more than one half of the participants, are telephone, night lighting, picnic tables and information aids. Overnight camping space was desired by about one quarter of all the participants.

When asked to rank sources of annoyance while driving, the participants ranked confusing and inadequate signs first by a fairly wide margin. This would seem to point out a serious problem -- the public is definitely not satisfied or happy with highway traffic signing as it presently exists; in fact it appears to be the principal source of annoyance to drivers on rural highways (congestion was not offered as a choice, but traffic and inept or incompetent drivers were possible choices). This suggests several courses of action, all of which should be explored by highway and traffic engineers on a high priority bases.

Official signs conveying information about motorist services were

considered; the conclusion reached is that this type of signing should contain brand name information and information as to type of service offered -- the signing often used saying "SERVICES THIS EXIT" and "GAS 1 mile" were not felt to be satisfactory.

Further Research

Techniques from the field of psychometric measurement offer possible solutions to a wide variety of problems rather hastily avoided by engineers in the past -- measurements of comfort, convenience, aesthetics of design, the list is endless!

This research could well be extended to better analyze junkyard screening by using a single junkyard and varying its screening -- the easiest (not necessairly the most logical) way would be to find one now well screened and systematically reduce its screening. In a film the reverse process could then be used and many variables eliminated. Also worth further study is the use of other than vegetation for screening purposes.

Similar techniques such as used in this investigation involving the use of films and experimental aesthetics could be used to evaluate the highway design features of alignment, geometrics and views of vistas.

The problem identified with traffic signing is most important and serious, it deserves immediate study as a follow-up.

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APPENDIXES

APPENDIX A

INVENTORY SUMMARIES

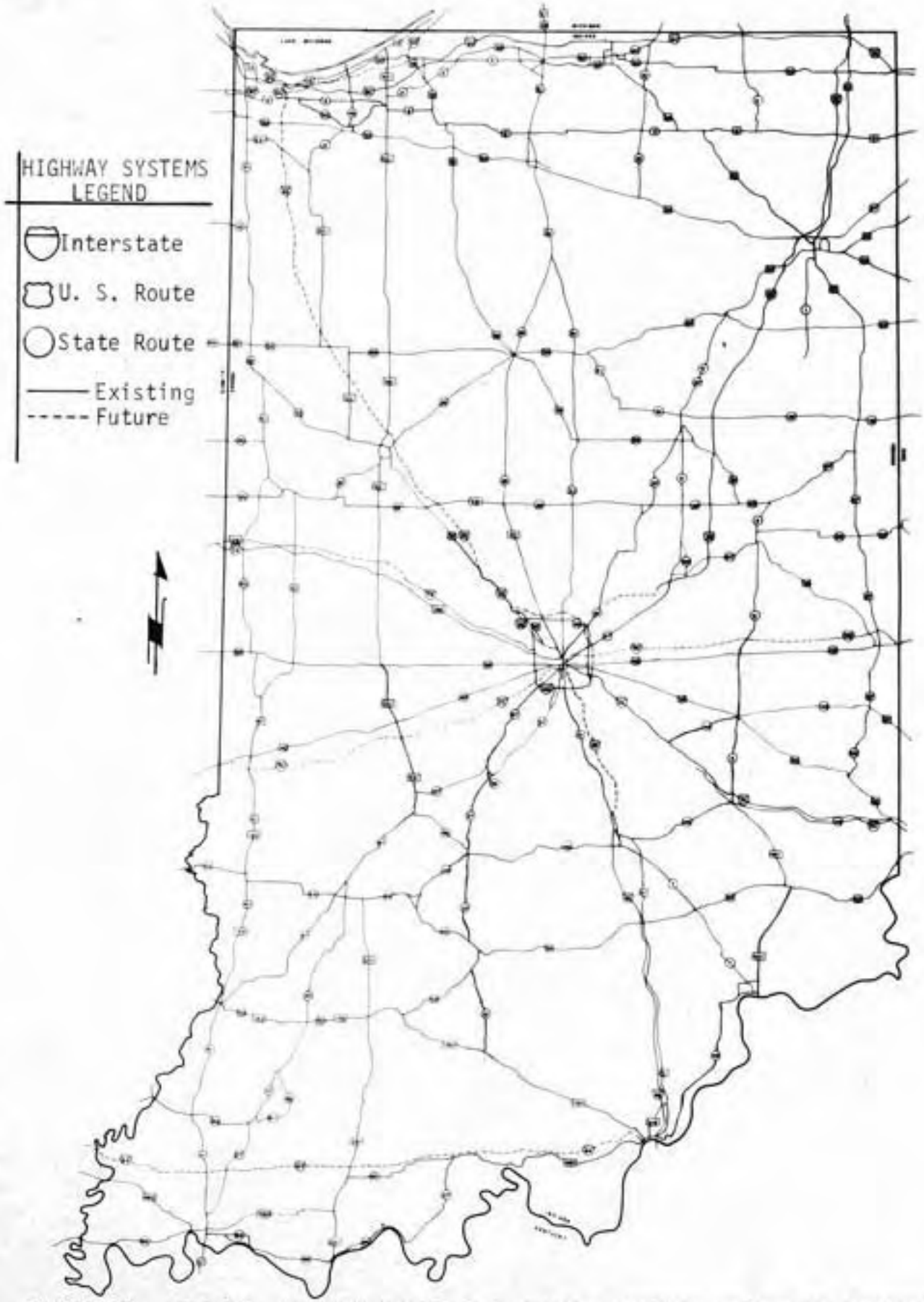


FIGURE A1. FEDERAL-AID INTERSTATE AND PRIMARY HIGHWAY SYSTEM IN INDIANA.

TABLE A1. SUMMARY OF SIGN SIZE DISTRIBUTION.*

	Size Range in Square Feet of Sign Area					
	<50	50-100	100-200	200-500	>500	no size**
Rural	21,107	2,470	2,172	2,694	416	694
Urban	6,581	623	1,075	1,478	113	500

* Compiled from I. S. H. C. Inventory, May 1966.

** Sign area not coded in inventory.

TABLE A2. DATA CODES FOR INVENTORY SUMMARY LEGENDS AND TABLES.

DATA CODING LEGENDS FOR I S M C INVENTORY DATA

HIGHWAY CLASSIFICATION IDENTIFICATION

CODE	LEGEND
1	INTERSTATE - FREE
2	INTERSTATE - TOLL
3	INTERSTATE TRAVELLED-WAY FREE
4	INTERSTATE TRAVELLED-WAY TOLL
5	OTHER FAP - FREE
6	OTHER FAP - TOLL

LAND USE CLASSIFICATION IDENTIFICATION

CODE	LEGEND
1	INDUSTRIAL - ZONED
2	INDUSTRIAL - UNZONED
3	COMMERCIAL - ZONED
4	COMMERCIAL - UNZONED
5	OTHER ACTIVITIES
6	ON ROW

JUNKYARD TYPE CLASSIFICATION IDENTIFICATION

CODE	LEGEND
1	AUTO GRAVEYARD
2	SCRAP METAL
3	USED BLDG. MATERIALS
4	REFUSE, GARBAGE OR TRASH DUMP
5	SANITARY FILLS
6	OTHER

SIZE RANGES USED

CODE	LEGEND
1	LESS THAN .5 ACRES
2	.5 TO 1 ACRES
3	1 TO 2 ACRES
4	2 TO 5 ACRES
5	5 TO 10 ACRES
6	10 TO 20 ACRES
7	20 TO 50 ACRES
8	GREATER THAN 50 ACRES

TABLE A3. SIGN DISTRIBUTION BY COUNTIES.

OUTDOOR ADVERTISING SIGN DISTRIBUTION IN INDIANA

COMPILED FROM I S H C INVENTORY, MAY 1966

	COUNTY	TOTAL SIGNS	SIGNS/PERSON	SIGNS/MILE(FAP)	EXPOSURES/PERSON
1	ADAMS	364	0.0149	0.0327	25.94
2	ALLEN	1217	0.0052	0.0484	22.93
3	BARTHOLOMEW	363	0.0071	0.0283	44.33
4	BENTON	218	0.0183	0.0197	173.72
5	BLACKFORD	38	0.0026	0.0061	1.03
6	BOONE	557	0.0202	0.0359	116.53
7	BROWN	65	0.0091	0.0119	15.69
8	CARROLL	121	0.0071	0.0187	22.71
9	CASS	368	0.0090	0.0266	23.84
10	CLARK	545	0.0067	0.0372	41.29
11	CLAY	361	0.0149	0.0327	162.79
12	CLINTON	393	0.0128	0.0329	45.87
13	CRAWFORD	128	0.0153	0.0143	0.15
14	DAVIESS	410	0.0229	0.0313	61.77
15	DEARBORN	318	0.0111	0.0270	64.47
16	DECATUR	412	0.0206	0.0448	64.99
17	DEKALB	275	0.0097	0.0206	41.95
18	DELAWARE	757	0.0068	0.0608	14.17
19	DUBOIS	311	0.0119	0.0267	0.11
20	ELKHART	683	0.0064	0.0362	15.32
21	FAYETTE	96	0.0039	0.0244	9.26
22	FLOYD	369	0.0072	0.0599	9.83
23	FOUNTAIN	457	0.0244	0.0378	88.84
24	FRANKLIN	335	0.0197	0.0375	41.65
25	FULTON	93	0.0055	0.0087	21.62
26	GIBSON	570	0.0190	0.0415	64.32
27	GRANT	723	0.0095	0.0426	87.06
28	GREENE	761	0.0289	0.0453	64.06
29	HAMILTON	394	0.0098	0.0272	31.75
30	HANCOCK	537	0.0201	0.0550	171.26
31	HARRISON	256	0.0134	0.0178	0.13
32	HENDRICKS	804	0.0197	0.0535	117.37
33	HENRY	475	0.0097	0.0405	71.18
34	HOWARD	209	0.0030	0.0245	19.06
35	HUNTINGTON	476	0.0141	0.0267	49.93
36	JACKSON	565	0.0185	0.0324	47.63
37	JASPER	223	0.0119	0.0164	24.88
38	JAY	301	0.0133	0.0260	37.26
39	JEFFERSON	192	0.0060	0.0158	14.51
40	JENNINGS	330	0.0191	0.0454	70.33
41	JOHNSON	368	0.0084	0.0451	99.20
42	KNOX	792	0.0191	0.0541	75.53
43	KOSCIUSKO	324	0.0080	0.0214	34.59
44	LAGRANGE	247	0.0142	0.0245	12.66
45	LAKE	2549	0.0050	0.1093	89.62
46	LAPORTE	1108	0.0116	0.0529	77.71
47	LAWRENCE	836	0.0243	0.0690	55.11
48	MADISON	917	0.0073	0.0478	29.26
49	MARION	1473	0.0021	0.0630	95.11
50	MARSHALL	434	0.0134	0.0278	49.42

TABLE A3. (Cont'd.)

OUTDOOR ADVERTISING SIGN DISTRIBUTION IN INDIANA

COMPILED FROM I S P C INVENTORY, MAY 1968

	COUNTY	TOTAL SIGNS	SIGNS/PERSON	SIGNS/MILE TRAFFIC	EXPOSURES/PERSON
51	MARTEN	417	0.0393	0.0518	98.17
52	MIAMI	166	0.0044	0.0133	9.42
53	MONROE	1116	0.0177	0.0193	29.16
54	MONTGOMERY	489	0.0157	0.0324	51.28
55	MORGAN	554	0.0164	0.0434	3.33
56	NEWTON	255	0.0227	0.0134	177.69
57	NOBLE	309	0.0113	0.0244	4.45
58	OHIO	1	0.0057	0.0067	0.00
59	ORANGE	484	0.0247	0.0538	3.29
60	OWEN	327	0.0247	0.0314	14.93
61	PARKE	572	0.0334	0.0631	117.40
62	PERRY	307	0.0174	0.0748	23.52
63	PIKE	235	0.0194	0.0212	17.00
64	PORTER	792	0.0121	0.0467	94.21
65	POSEY	371	0.0191	0.3448	51.15
66	PULASKI	220	0.0171	0.0228	44.92
67	PUTNAM	783	0.0314	0.0560	174.45
68	RANDOLPH	359	0.0119	0.0257	44.51
69	RIPLEY	473	0.0229	0.0458	73.39
70	RUSH	477	0.0236	0.0583	76.50
71	ST.JOSEPH	379	0.0016	0.0032	63.95
72	SCOTT	196	0.0134	0.0238	34.98
73	SHELBY	205	0.0065	0.0428	21.05
74	SPENCER	669	0.0411	0.0468	13.50
75	STARKE	144	0.0097	0.0137	35.34
76	STEUBEN	405	0.0236	0.1343	131.49
77	SULLIVAN	551	0.0296	0.0475	170.29
78	SWITZERLAND	0	0.	0.	0.
79	TIPPECANOE	919	0.0181	0.0562	78.02
80	TIPTON	393	0.0242	0.0437	191.05
81	UNION	164	0.0240	0.0430	16.48
82	VANDERBURGH	739	0.0045	0.0970	82.58
83	VERMILLION	236	0.0131	0.0254	18.37
84	VIGO	1042	0.0096	0.0874	196.98
85	WABASH	87	0.0090	0.0066	0.00
86	WARREN	272	0.0818	0.0299	72.93
87	WARRICK	354	0.0142	0.0282	7.69
88	WASHINGTON	69	0.0031	0.0059	0.24
89	WAYNE	711	0.0096	0.0473	87.19
90	WELLS	151	0.0071	0.0101	21.54
91	WHITE	434	0.0294	0.0359	39.32
92	WHITLEY	183	0.0061	0.0129	12.21

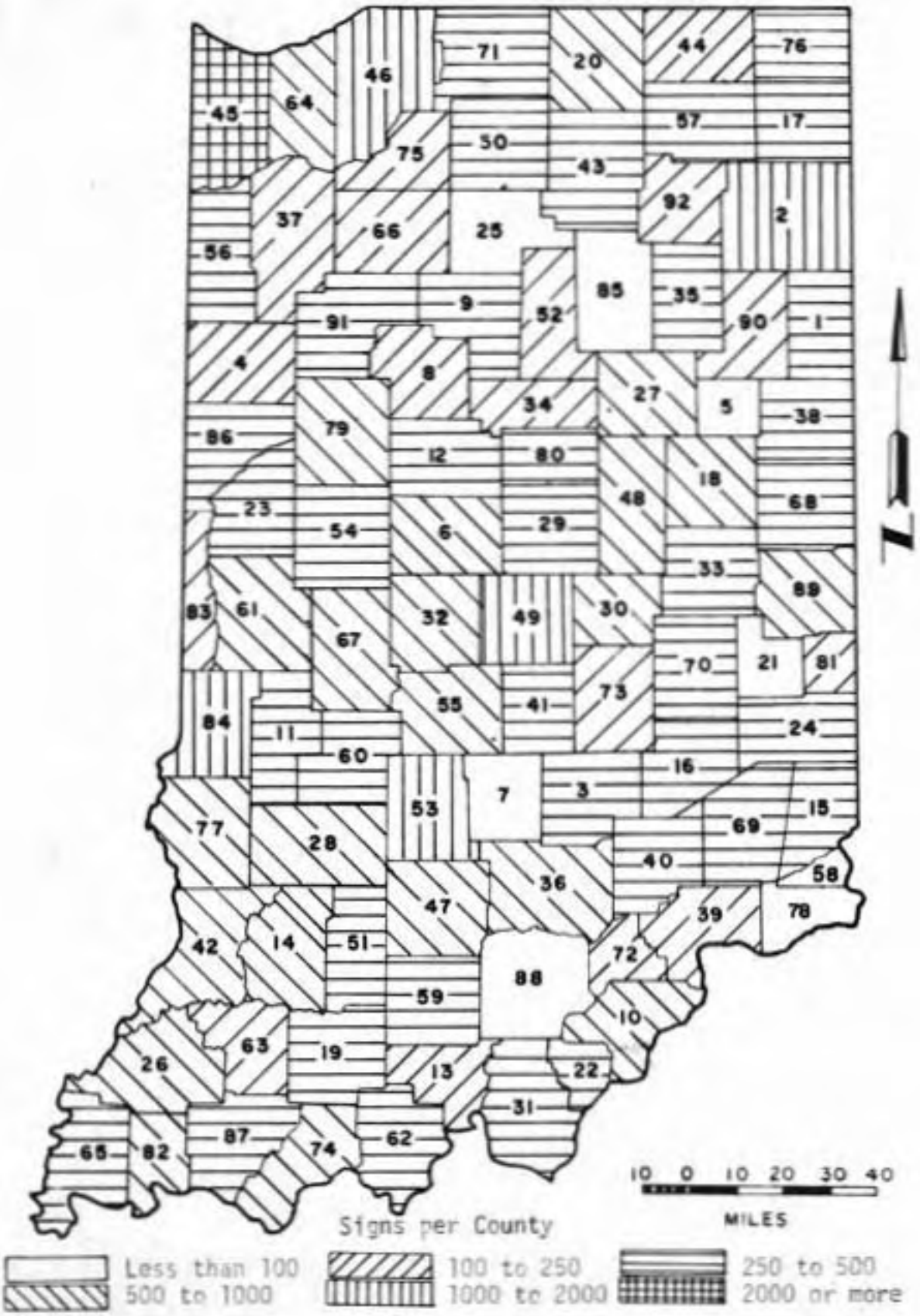


FIGURE A2. BILLBOARD DISTRIBUTION BY COUNTIES.

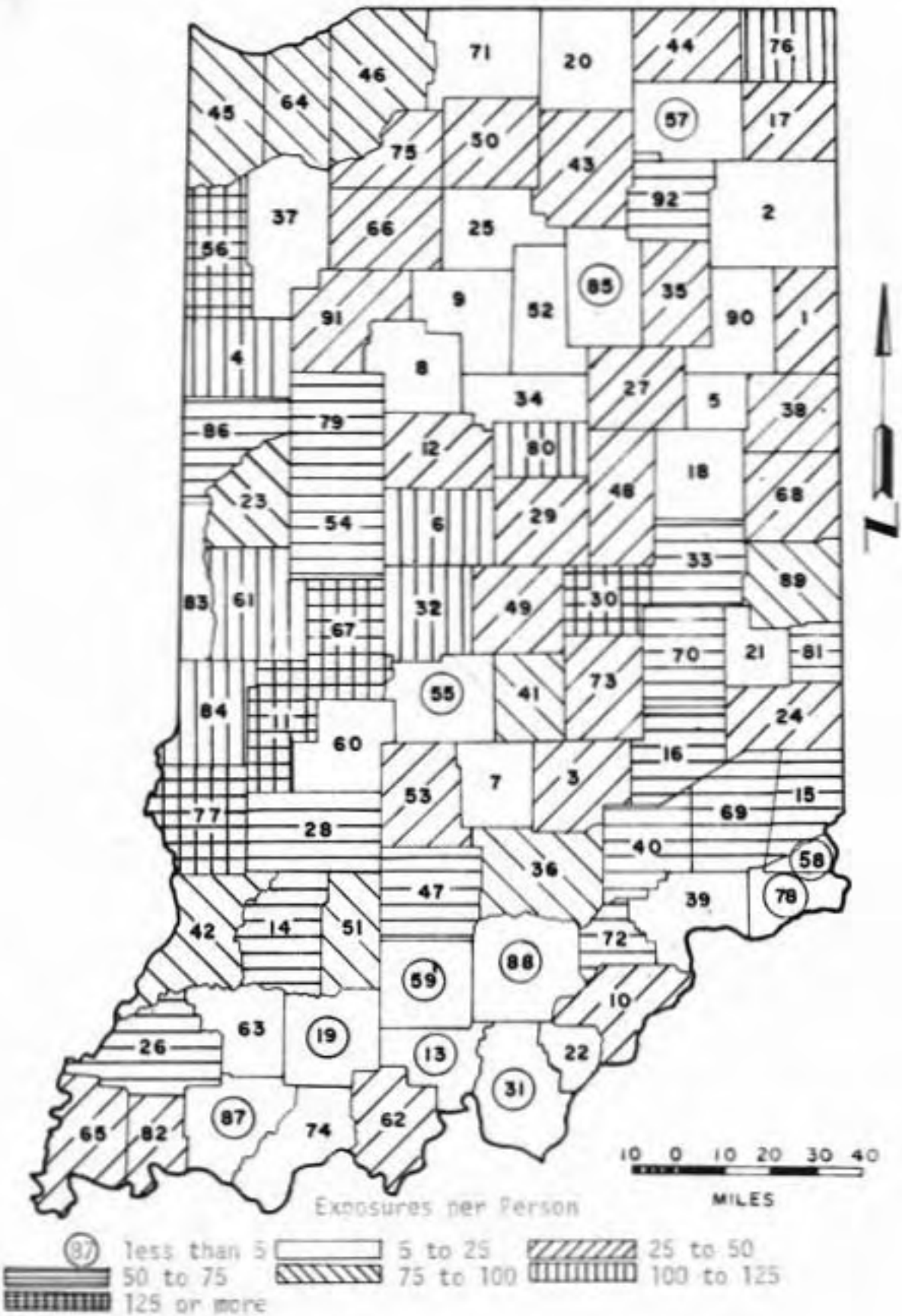


FIGURE A3. EXPOSURES TO BILLBOARDS PER PERSON BY COUNTIES.

TABLE A4. BILLBOARD DISTRIBUTION BY COUNTIES BY HIGHWAY CLASSIFICATION AND LAND USE.

OUTDOOR ADVERTISING SIGN DISTRIBUTION IN INDIANA

COMPILED FROM I. S. H. C. INVENTORY, MAY 1969

RURAL

COUNTY	HIGHWAY CLASSIFICATION						LAND USE CLASSIFICATION					
	1	2	3	4	5	6	1	2	3	4	5	6
1	0	0	0	0	108	0	0	0	0	0	296	12
2	56	0	0	0	714	0	0	0	71	0	647	52
3	11	0	0	0	274	0	1	0	4	0	285	15
4	0	0	0	0	158	0	0	0	0	2	145	11
5	0	0	0	0	33	0	0	0	0	0	33	0
6	130	0	0	0	358	1	1	0	5	0	452	30
7	0	0	0	0	61	0	0	0	0	0	58	3
8	0	0	0	0	116	0	0	0	0	0	108	8
9	0	0	0	0	288	0	14	0	21	3	219	29
10	160	0	1	0	913	0	0	0	141	0	780	33
11	0	0	0	0	220	0	0	0	0	0	204	16
12	0	0	0	0	452	0	0	0	13	0	420	19
13	0	0	0	0	128	0	0	0	0	0	107	13
14	0	0	0	0	464	0	0	0	4	0	387	61
15	58	0	0	0	168	0	0	0	0	0	182	24
16	61	0	0	0	327	0	0	0	0	0	356	12
17	27	0	4	0	214	0	2	0	0	0	233	12
18	90	0	0	0	514	0	0	0	15	17	441	70
19	0	0	0	0	234	0	0	0	0	2	207	25
20	0	22	0	0	463	0	1	0	0	5	470	9
21	0	0	0	0	91	0	0	0	0	0	89	2
22	0	1	0	0	212	0	0	0	52	5	139	17
23	8	0	0	0	359	0	0	0	0	20	329	18
24	85	1	0	0	274	0	0	3	0	7	258	17
25	0	0	0	0	80	0	0	0	12	0	67	1
26	0	0	0	0	447	0	0	0	0	0	440	56
27	3	0	0	0	446	0	0	0	80	0	348	69
28	0	0	0	0	506	0	0	1	0	10	420	75
29	0	0	0	0	385	0	0	0	4	0	353	23
30	0	0	0	0	377	0	0	0	0	1	318	58
31	0	0	0	0	219	0	0	0	0	2	208	9
32	42	0	0	0	601	0	0	0	0	1	536	106
33	0	0	0	0	366	0	0	0	14	0	284	63
34	0	0	0	0	136	0	0	0	1	0	125	8
35	9	0	0	0	339	1	0	0	4	5	311	27
36	93	0	0	0	405	0	0	0	12	0	457	29
37	0	0	0	0	210	0	2	0	34	0	155	17
38	0	0	0	0	266	0	0	0	0	5	244	17
39	0	0	0	0	148	0	0	0	0	0	146	2
40	0	0	0	0	284	0	0	0	0	0	256	28
41	0	0	0	0	271	0	0	0	0	15	232	24
42	0	0	0	0	548	0	0	0	5	18	490	85
43	0	0	0	0	258	0	0	0	0	12	240	6
44	0	22	0	0	201	0	0	0	0	0	217	6
45	46	3	1	0	613	0	1	0	34	0	384	184
46	0	18	0	1	810	0	4	0	56	21	646	82
47	0	0	0	0	687	0	0	0	11	6	571	99
48	23	0	0	0	462	0	3	0	64	12	348	57
49	175	0	4	0	637	0	7	0	30	28	619	133
50	0	0	0	0	369	0	0	0	52	0	308	9

URBAN

COUNTY	HIGHWAY CLASSIFICATION						LAND USE CLASSIFICATION					
	1	2	3	4	5	6	1	2	3	4	5	6
1	0	0	0	0	56	3	0	0	3	5	1	44	6
2	0	0	0	0	467	1	0	0	3	214	1	221	30
3	0	0	0	0	78	1	3	0	3	50	0	23	8
4	0	0	0	0	63	7	2	0	3	8	4	37	6
5	0	0	0	0	5	3	0	0	3	0	0	5	0
6	0	0	0	0	67	1	0	0	0	4	0	15	49
7	0	0	0	0	6	3	2	0	3	0	0	6	0
8	0	0	0	0	5	3	0	0	3	0	0	4	1
9	0	0	0	0	83	3	6	0	3	52	1	18	3
10	0	0	0	0	99	3	15	0	3	69	0	5	6
11	0	0	0	0	141	3	3	0	3	6	0	1	134
12	0	0	0	0	91	3	3	0	3	18	0	10	14
13	0	0	0	0	8	3	0	0	0	0	0	0	0
14	0	0	0	0	146	3	0	0	0	27	6	61	52
15	0	0	0	0	112	3	3	0	3	0	77	12	23
16	0	0	0	0	44	3	3	0	3	1	0	25	10
17	0	0	0	0	28	3	3	0	3	0	3	25	0
18	0	0	0	0	213	3	23	0	3	37	7	32	117
19	0	0	0	0	77	3	3	0	3	8	0	48	20
20	0	0	0	0	198	3	47	0	3	0	19	130	2
21	0	0	0	0	5	3	0	0	3	0	0	3	2
22	0	0	0	0	146	3	0	0	0	107	0	22	27
23	0	0	0	0	89	3	3	0	3	13	17	38	21
24	0	0	0	0	53	3	3	0	3	3	18	6	26
25	0	0	0	0	11	3	0	0	3	4	0	9	0
26	0	0	0	0	76	3	3	0	3	2	5	31	35
27	0	0	0	0	276	3	3	0	3	17	2	61	193
28	0	0	0	0	255	3	3	0	3	0	43	129	84
29	0	0	0	0	8	3	0	0	3	0	0	8	1
30	0	0	0	0	163	3	0	0	3	40	0	9	109
31	0	0	0	0	39	3	3	0	3	0	1	25	13
32	0	0	0	0	565	3	3	0	3	4	18	25	113
33	0	0	0	0	109	3	3	0	3	6	0	32	71
34	0	0	0	0	79	3	3	0	3	19	0	18	34
35	0	0	0	0	127	3	3	0	3	5	8	44	70
36	0	0	0	0	67	3	3	0	3	43	0	22	2
37	0	0	0	0	19	3	4	0	3	1	2	6	0
38	0	0	0	0	35	3	3	0	3	0	5	15	14
39	0	0	0	0	44	3	3	0	3	11	0	33	0
40	0	0	0	0	46	3	3	0	3	1	6	24	15
41	0	0	0	0	97	3	3	0	3	1	31	45	16
42	0	0	0	0	194	3	3	0	3	16	30	109	35
43	0	0	0	0	66	3	3	0	3	0	2	41	3
44	0	0	0	0	24	3	3	0	3	0	0	22	2
45	19	46	1	0	1823	3	822	0	3	405	2	321	756
46	0	0	0	0	274	3	27	0	3	77	14	60	76
47	0	0	0	0	149	3	0	0	3	61	5	56	47
48	0	0	0	0	430	3	45	0	3	192	10	32	213
49	0	0	0	0	649	1	79	0	3	263	56	86	171
50	0	0	0	1	64	3	0	0	3	41	0	20	4

TABLE A4. (Cont'd.)

OUTDOOR ADVERTISING SIGN DISTRIBUTION IN INDIANA

COMPILED FROM I. S. H. C. INVENTORY, MAY 1966

	RURAL												URBAN											
	HIGHWAY CLASSIFICATION						LAND USE CLASSIFICATION						HIGHWAY CLASSIFICATION						LAND USE CLASSIFICATION					
COUNTY	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
51	0	0	0	0	316	0	0	0	0	4	258	54	0	0	0	0	101	3	3	0	0	37	28	36
52	0	0	0	0	154	0	0	0	4	0	145	1	0	0	0	0	17	3	3	0	0	0	10	2
53	0	0	0	0	565	0	0	0	51	8	366	140	0	0	0	0	451	3	0	3	147	0	43	261
54	8	0	0	0	426	0	0	0	11	0	395	29	0	0	0	0	55	3	0	3	22	4	15	14
55	0	0	0	0	386	0	0	0	3	4	305	77	0	0	0	0	168	3	0	3	26	4	24	112
56	0	0	0	0	232	0	0	0	12	4	208	8	0	0	0	0	28	3	1	3	7	0	10	1
57	0	0	0	0	279	0	0	0	0	0	271	8	0	0	0	0	33	3	0	0	0	0	29	2
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	1
59	0	0	0	0	386	0	0	0	0	37	322	27	0	0	0	0	96	3	3	3	0	42	8	48
60	0	0	0	0	274	0	0	0	0	1	177	96	0	0	0	0	53	3	3	3	0	10	14	29
61	0	0	0	0	499	0	1	0	4	6	422	66	0	0	0	0	73	3	0	0	0	9	15	48
62	0	0	0	0	250	0	0	0	12	9	188	41	0	0	0	0	57	3	0	0	0	0	8	7
63	0	0	0	0	171	0	0	0	0	0	124	47	0	0	0	0	64	3	0	0	0	1	20	32
64	0	7	0	0	498	0	37	0	43	0	325	80	0	0	0	0	227	3	15	3	40	0	63	109
65	0	0	0	0	301	0	0	0	1	11	228	61	0	0	0	0	73	3	1	3	11	12	13	33
66	0	0	0	0	210	0	0	0	14	0	195	1	0	0	0	0	13	3	0	0	5	0	2	3
67	0	0	0	0	680	1	0	0	0	5	600	76	0	0	1	0	101	3	0	0	17	3	16	66
68	0	0	0	0	296	0	0	0	0	0	271	25	0	0	0	0	42	3	0	0	0	0	22	19
69	13	0	0	0	385	0	0	0	0	0	173	29	0	0	0	0	71	3	2	0	0	4	59	9
70	0	0	0	0	423	0	0	0	21	3	393	6	0	0	0	0	54	3	0	0	15	0	15	24
71	0	15	0	0	221	0	0	0	64	0	154	13	0	0	1	0	142	3	0	3	52	0	76	6
72	54	0	0	0	98	0	0	0	10	0	137	8	0	0	0	0	91	3	2	3	16	0	21	2
73	90	0	0	0	109	0	0	0	0	1	102	6	0	0	0	0	15	3	0	0	0	0	3	12
74	0	0	0	0	574	0	0	0	0	4	486	84	0	0	0	0	95	3	0	0	0	12	64	19
75	0	0	0	0	144	0	0	0	0	0	135	1	0	0	0	0	2	3	0	0	2	0	0	0
76	0	24	21	0	334	0	4	0	1	0	251	21	0	0	0	0	26	3	0	0	2	0	16	2
77	0	0	0	0	422	0	0	0	2	5	375	40	0	0	0	0	133	3	0	0	15	1	52	65
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
79	0	0	0	0	718	0	19	0	50	33	510	111	0	0	0	0	231	3	5	0	22	14	24	135
80	0	0	0	0	318	0	0	4	4	0	282	24	0	0	0	0	55	3	3	0	6	0	4	55
81	0	0	0	0	150	0	0	0	0	1	144	5	0	0	0	0	19	3	0	0	2	0	11	5
82	8	0	0	0	384	0	0	0	19	0	324	42	0	0	0	0	354	3	4	0	257	0	11	92
83	12	0	0	0	216	0	0	0	0	2	193	33	0	0	0	0	8	3	0	0	0	0	6	2
84	0	0	0	0	458	0	4	0	0	15	347	93	0	0	0	0	583	3	16	8	91	93	34	341
85	0	0	0	0	89	0	0	0	0	0	89	0	0	0	0	0	9	3	0	0	0	0	0	0
86	0	0	0	0	260	0	0	11	0	30	199	20	0	0	0	0	12	3	0	0	0	1	3	7
87	0	0	0	0	262	0	0	0	2	0	202	58	0	0	0	0	91	3	0	0	9	0	27	55
88	0	0	0	0	51	0	0	0	0	0	47	4	0	0	0	0	18	3	0	0	0	0	16	2
89	42	0	0	0	296	0	0	0	1	0	268	69	0	0	0	0	375	3	21	0	44	0	102	202
90	0	0	0	0	139	0	0	0	2	0	113	24	0	0	0	0	13	3	0	0	3	0	8	1
91	0	0	0	0	375	0	0	0	0	0	336	31	0	0	0	0	64	3	3	0	17	0	37	9
92	0	0	0	0	177	0	0	0	0	0	172	4	0	0	0	0	6	3	3	0	0	0	6	0
TOTAL	1100	113	55		129339	3	44	48	5		111451	4	97	24	1161		31625578	3323	546	8	2774	634	3075	4478

TABLE A5. BILLBOARD EXPOSURE DISTRIBUTION BY COUNTIES.

OUTDOOR ADVERTISING SIGN DISTRIBUTION IN INDIANA

COMPILED FROM I S H C INVENTORY, MAY 1966

COUNTY	SIGNS			VIEWS		
	RURAL	URBAN	TOTAL	RURAL	URBAN	TOTAL
1	308	56	364	516467	121026	637493
2	750	467	1217	3042023	2277483	5319506
3	265	78	343	1800600	452200	2252800
4	158	60	218	1062700	375300	1438000
5	33	5	38	62900	11500	74400
6	489	68	557	3037600	372000	3209600
7	61	4	65	102600	7200	109800
8	116	5	121	364000	20500	384500
9	288	80	368	708318	268122	976440
10	474	71	545	1940188	650406	2590594
11	220	141	361	2307100	1612000	3919100
12	352	41	393	1262900	144200	1411100
13	128	0	128	128	0	128
14	464	146	610	1229963	413457	1643420
15	206	112	318	768600	1085700	1854300
16	368	44	412	1138600	162400	1301000
17	247	28	275	1106590	78518	1185108
18	544	213	757	1366210	202685	1568895
19	234	77	311	234	77	311
20	485	198	683	850172	782104	1632276
21	91	5	96	211400	15000	226400
22	213	156	369	145480	255124	400104
23	367	90	457	1262600	418000	1680600
24	285	50	335	598400	110300	708700
25	80	13	93	318300	45000	363300
26	497	73	570	1859140	64656	1923796
27	449	274	723	980404	1914625	2895029
28	506	255	761	1077088	606513	1683601
29	385	9	394	1221266	51400	1272666
30	377	160	537	2743383	1722432	4465795
31	219	39	258	219	39	258
32	843	161	804	3690598	1107255	4797853
33	366	109	475	2548700	932000	3480700
34	136	73	209	706800	544200	1251000
35	349	127	476	1045398	609057	1654455
36	458	67	565	2351900	310500	2662400
37	210	13	223	453235	14208	467443
38	266	35	301	759628	80016	839647
39	148	44	192	252069	139807	391876
40	284	46	330	971900	242500	1214400
41	271	97	368	3024826	1310500	4335326
42	598	194	792	2095310	1041468	3136778
43	258	66	324	1046292	328720	1375012
44	223	24	247	515485	46412	561897
45	663	1886	2549	8461007	37642513	46103520
46	829	279	1108	4484896	2907400	7392296
47	687	149	836	1269828	619275	1889103
48	485	432	917	807720	2869399	3677119
49	818	655	1473	9375462	15115000	24490462
50	369	65	434	1307549	310513	1618062

TABLE A5. (Cont'd.)

OUTDOOR ADVERTISING SIGN DISTRIBUTION IN INDIANA

COMPILED FROM I S H C INVENTORY, MAY 1968

	SIGNS			VIEWS		
COUNTY	RURAL	URBAN	TOTAL	RURAL	URBAN	TOTAL
51	316	101	417	659085	274802	933887
52	154	12	166	288438	30782	319160
53	565	451	1016	1208996	537042	1746038
54	434	55	489	1284200	489630	1773830
55	386	168	554	386	5867	6253
56	232	23	255	1300450	97614	1398064
57	279	30	309	123031	30	123061
58	0	1	1	0	1	1
59	385	99	484	186	99	285
60	274	53	327	200134	23894	224028
61	459	73	532	1658437	77758	1736195
62	250	57	307	272946	217706	490652
63	171	64	235	175388	40948	216336
64	565	227	792	3603265	1776630	5379895
65	301	70	371	530852	142942	673794
66	210	10	220	566200	32500	598700
67	681	102	783	2811382	414009	3225391
68	296	42	338	972100	150430	1122530
69	402	71	473	1201200	291705	1492905
70	423	54	477	1329500	230908	1560408
71	236	143	379	1944327	816701	2761028
72	155	41	196	668300	151405	819705
73	189	16	205	431303	54810	486113
74	574	95	669	162384	41477	203861
75	144	2	146	621900	11100	633000
76	379	26	405	1825500	184700	2010200
77	422	133	555	1947500	834100	2781600
78	0	0	0	0	0	0
79	718	201	919	5157100	1796200	6953300
80	319	65	383	1353900	280100	1634000
81	150	18	168	309300	36000	345300
82	384	354	738	2579117	2479092	5058409
83	220	8	228	297886	26250	324136
84	459	583	1042	4226500	3159400	11177933
85	89	8	97	89	8	97
86	260	12	272	576900	28105	605005
87	262	72	334	262	72	334
88	51	18	69	51	18	69
89	338	375	713	2496900	3955900	6452800
90	139	12	151	433044	15009	448053
91	375	63	438	616675	64736	681411
92	177	6	183	1053504	56700	1096204

TOTAL VIEWS = 227174280

FIGURE A4. JUNKYARD DISTRIBUTION BY COUNTIES.

TABLE A6. DISTRIBUTION OF JUNKYARD TYPES BY COUNTIES.

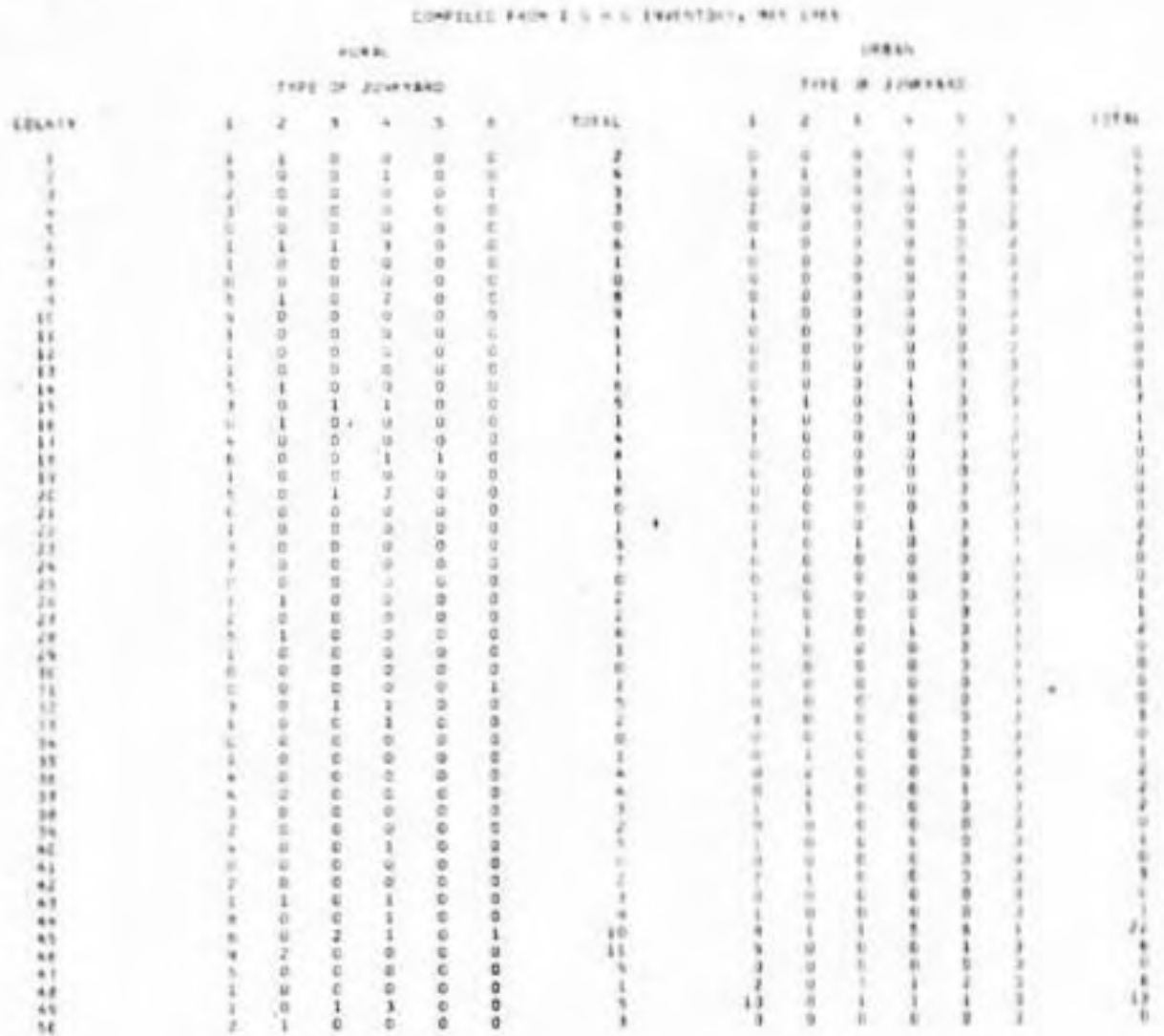


TABLE A6. (Cont'd.)

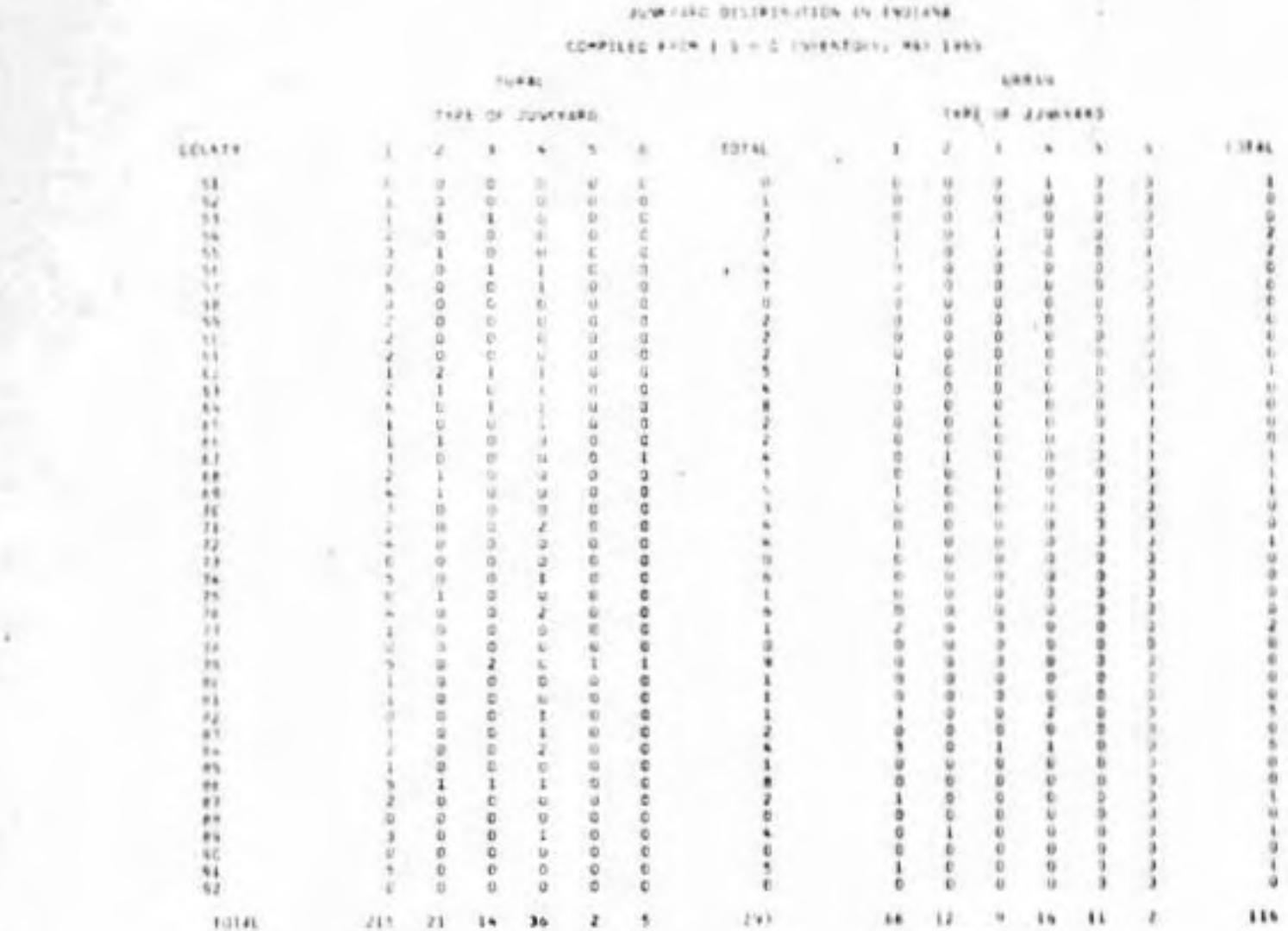


TABLE A7. JUNKYARD DISTRIBUTION BY LAND USE CLASSIFICATION.

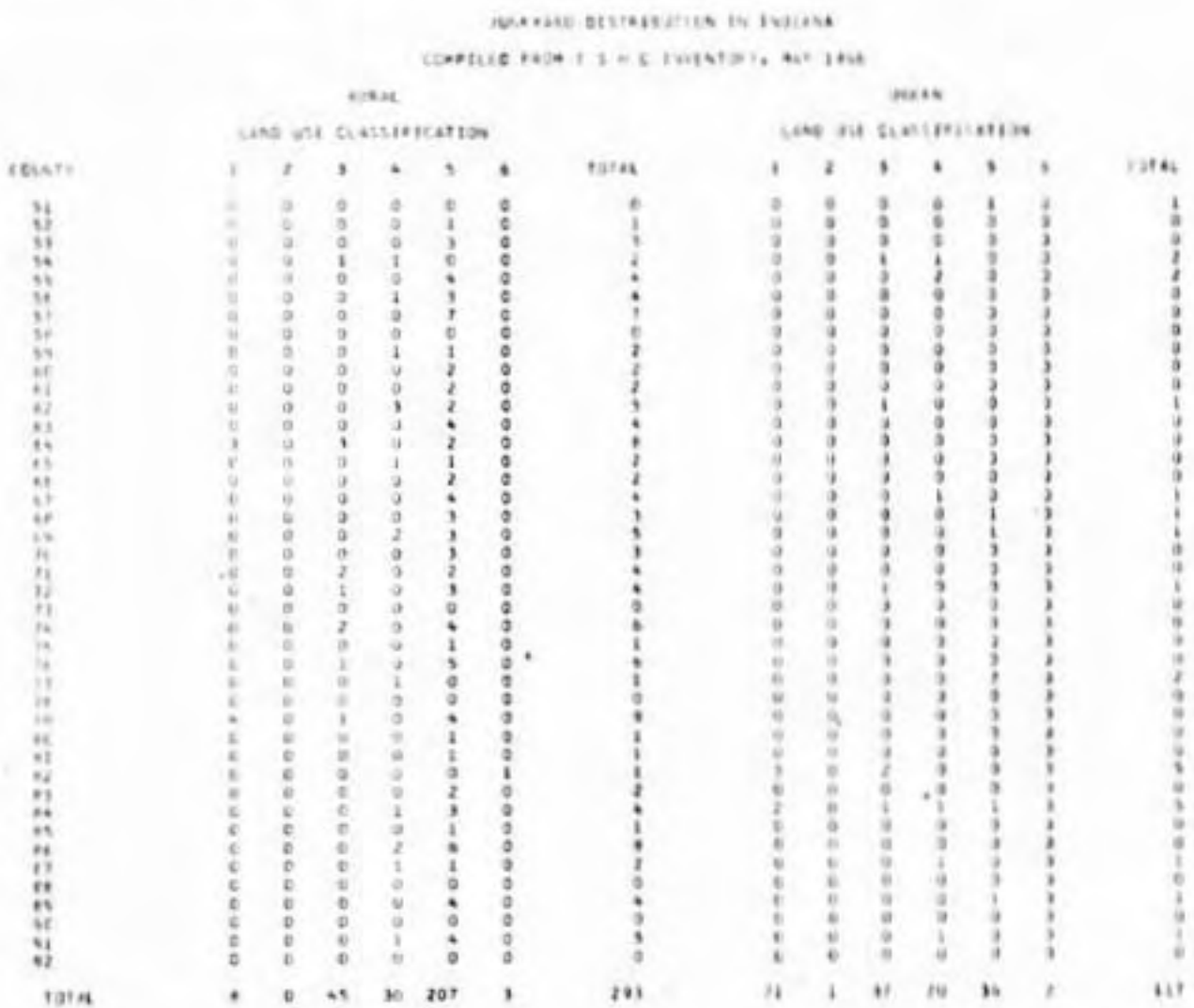


TABLE A7. (Cont'd.)

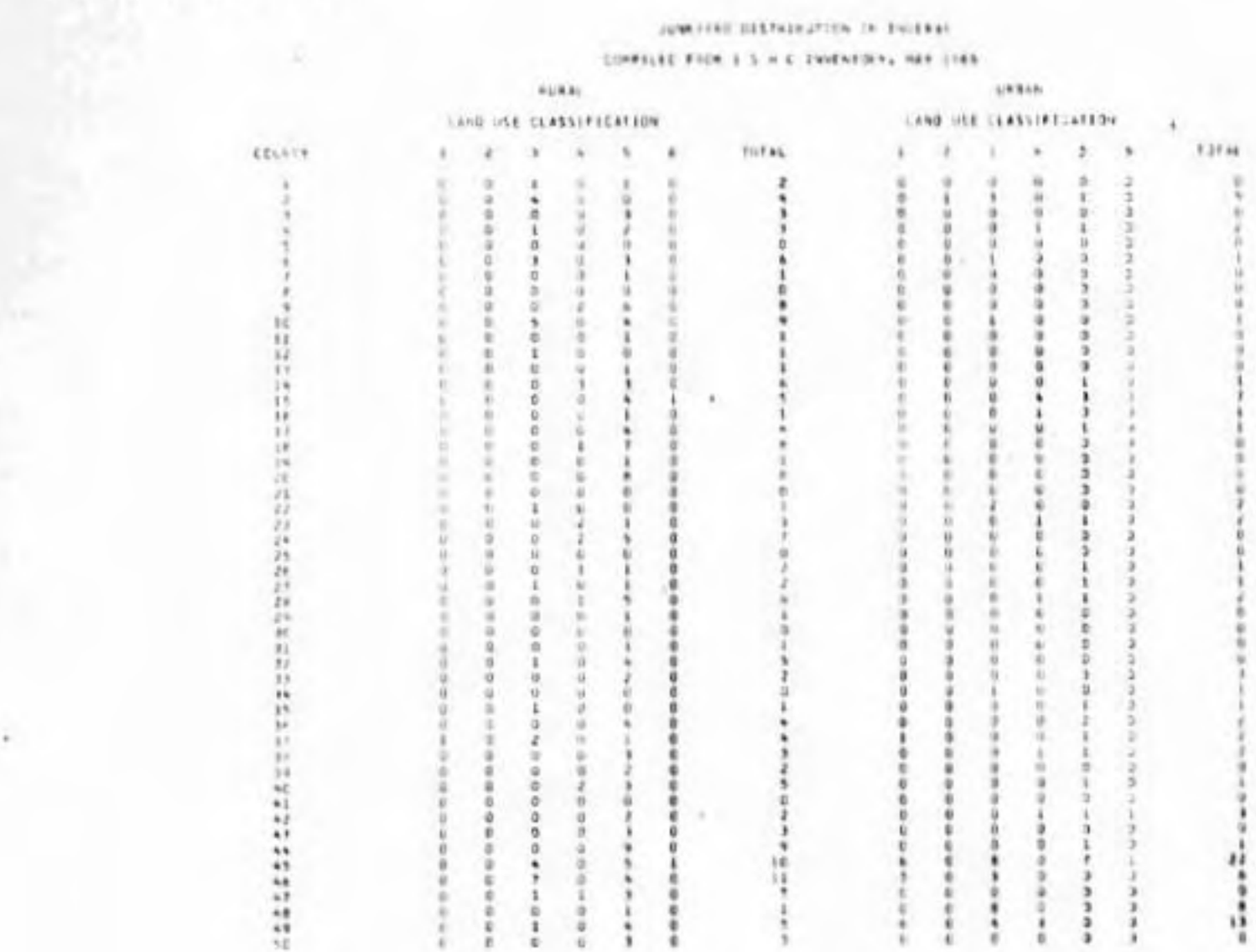


TABLE A8. JUNKYARD DISTRIBUTION BY HIGHWAY CLASSIFICATION.

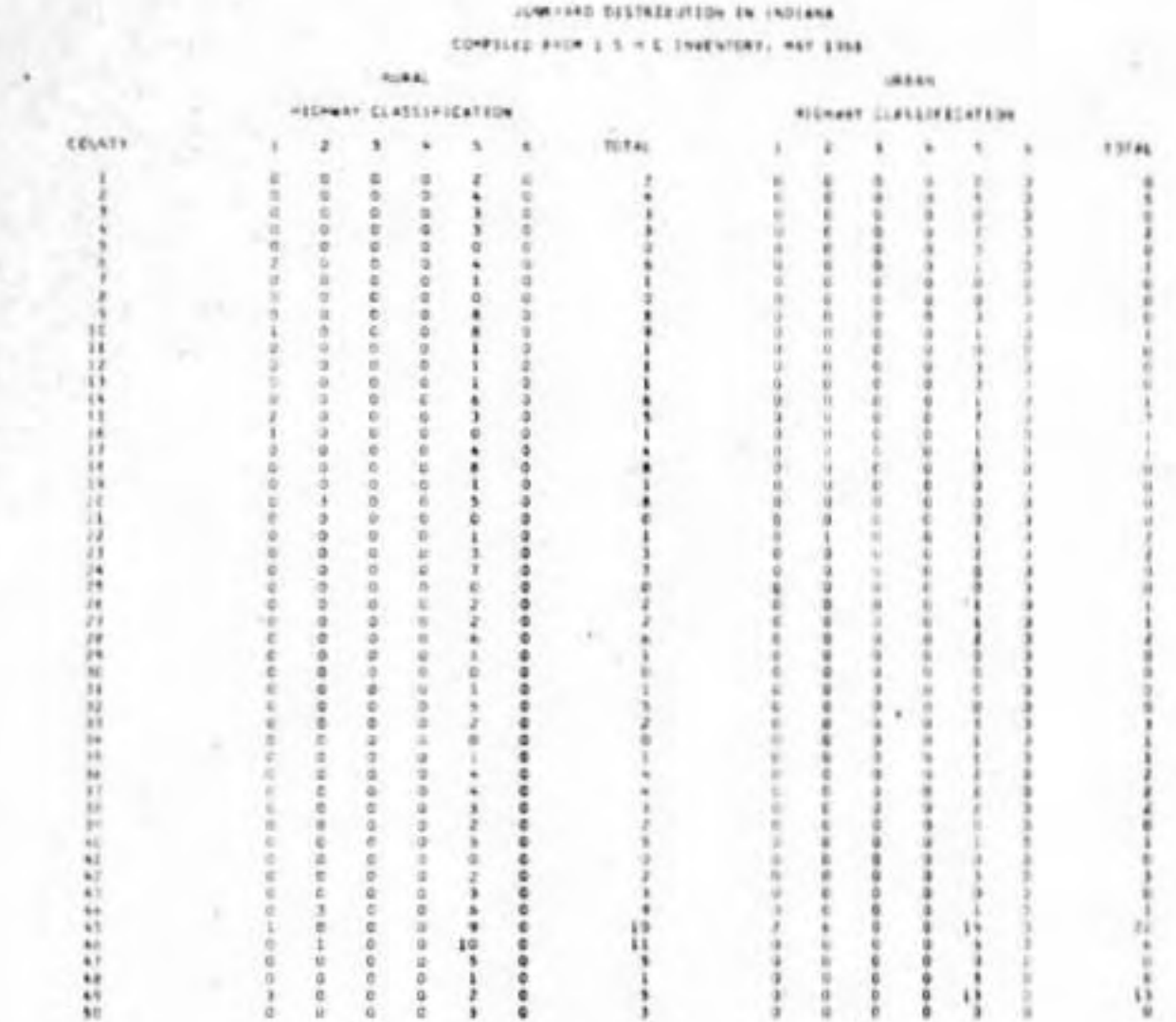


TABLE A8. (Cont'd.)

JUMPARD DISTRIBUTION IN INDIANA

COMPILED FROM I. S. H. C. INVENTORY, MAY 1968

COUNTY	RURAL HIGHWAY CLASSIFICATION							URBAN HIGHWAY CLASSIFICATION						
	1	2	3	4	5	6	TOTAL	1	2	3	4	5	6	TOTAL
51	0	0	0	0	0	0	0	0	0	0	0	1	0	1
52	0	0	0	0	1	0	1	0	0	0	0	0	0	0
53	0	0	0	0	3	0	3	0	0	0	0	0	0	0
54	0	0	0	0	2	0	2	0	0	0	0	2	0	2
55	0	0	0	0	4	0	4	0	0	0	0	2	0	2
56	0	0	0	0	4	0	4	0	0	0	0	0	0	0
57	0	0	0	0	7	0	7	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	2	0	2	0	0	0	0	0	0	0
60	0	0	0	0	2	0	2	0	0	0	0	0	0	0
61	0	0	0	0	2	0	2	0	0	0	0	0	0	0
62	0	0	0	0	5	0	5	0	0	0	0	1	0	1
63	0	0	0	0	4	0	4	0	0	0	0	0	0	0
64	0	0	0	0	8	0	8	0	0	0	0	0	0	0
65	0	0	0	0	2	0	2	0	0	0	0	0	0	0
66	0	0	0	0	2	0	2	0	0	0	0	0	0	0
67	0	0	0	0	4	0	4	0	0	0	0	1	0	1
68	0	0	0	0	3	0	3	0	0	0	0	1	0	1
69	0	0	0	0	5	0	5	0	0	0	0	1	0	1
70	0	0	0	0	3	0	3	0	0	0	0	0	0	0
71	0	0	0	0	4	0	4	0	0	0	0	0	0	0
72	0	0	0	0	4	0	4	0	0	0	0	1	0	1
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	6	0	6	0	0	0	0	0	0	0
75	0	0	0	0	1	0	1	0	0	0	0	0	0	0
76	0	0	0	0	4	0	4	0	0	0	0	0	0	0
77	0	0	0	0	1	0	1	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	1	0	1	0	0	0	0	0	0	0
81	0	0	0	0	1	0	1	0	0	0	0	0	0	0
82	0	0	0	0	1	0	1	0	0	0	0	0	0	0
83	0	0	0	0	2	0	2	0	0	0	0	0	0	0
84	0	0	0	0	4	0	4	0	0	0	0	0	0	0
85	0	0	0	0	1	0	1	0	0	0	0	0	0	0
86	0	0	0	0	8	0	8	0	0	0	0	0	0	0
87	0	0	0	0	2	0	2	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	2	0	0	0	2	0	4	0	0	0	0	1	0	1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	5	0	5	0	0	0	0	1	0	1
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	12	9	0	0	272	0	293	2	7	0	0	108	0	117

TABLE A9. JUNKYARD DISTRIBUTION BY SIZE RANGES.

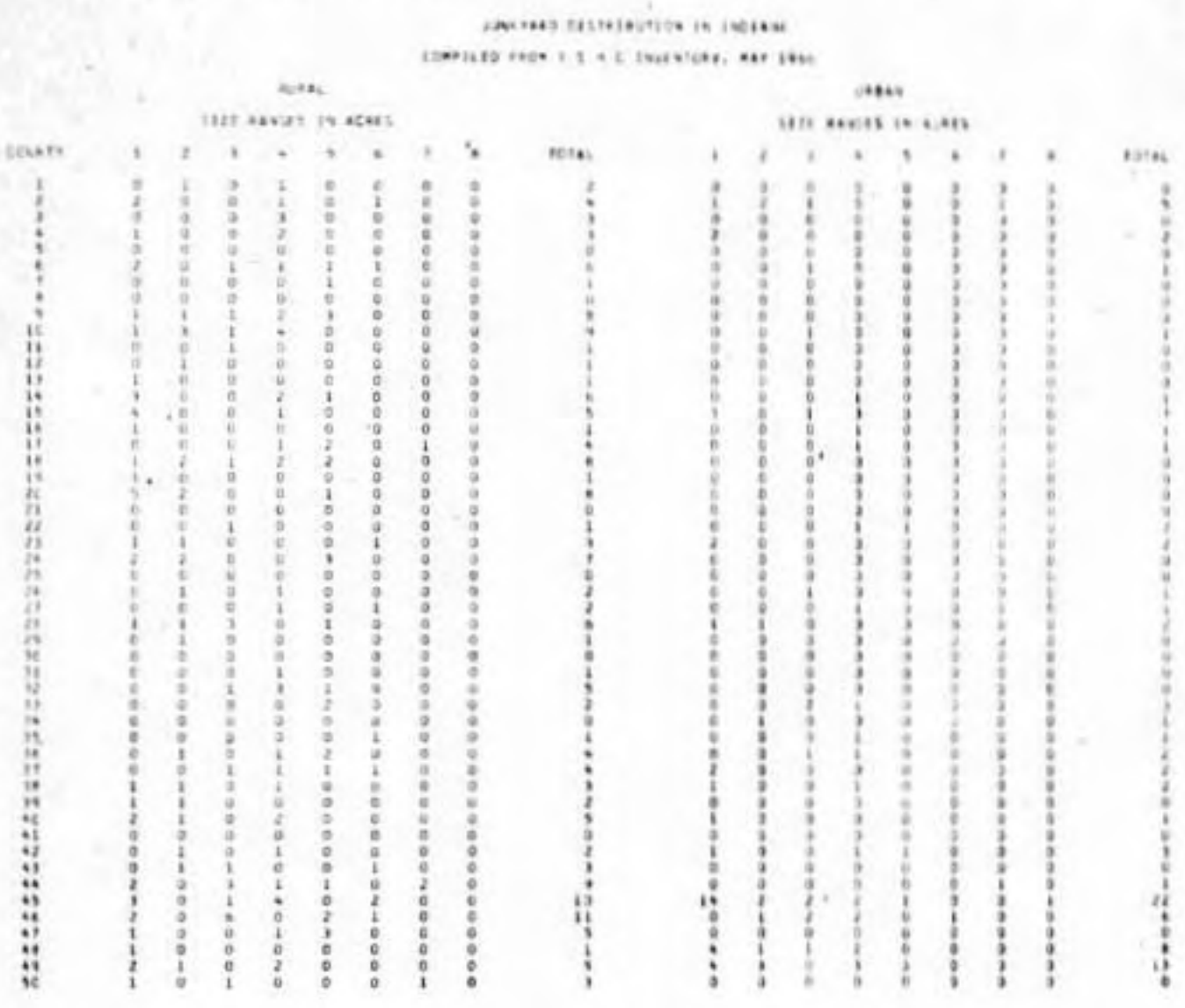
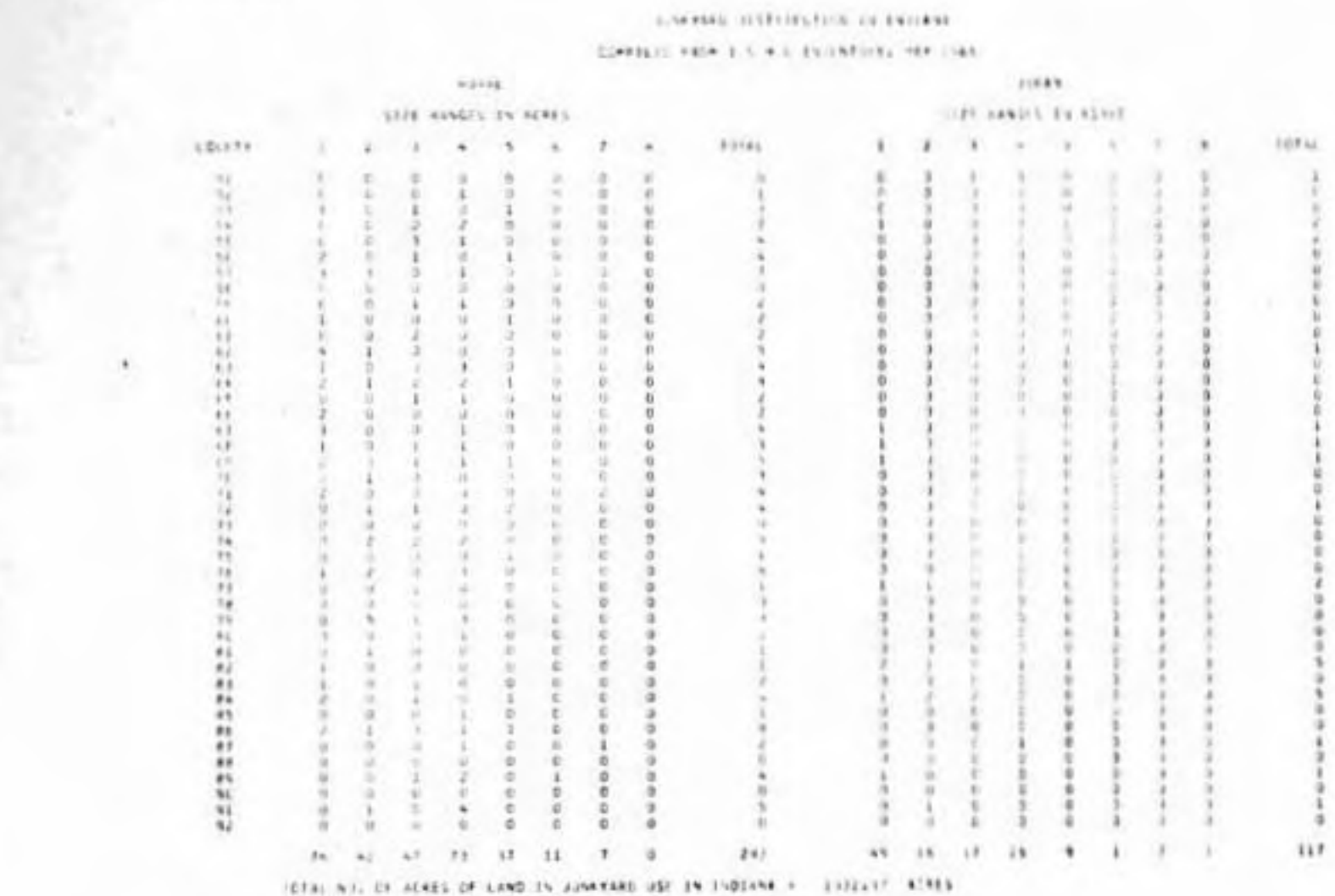


TABLE A9. (Cont'd.)



APPENDIX B

TYPICAL FILM INTRODUCTIONS AND DATA CODING SHEETS

APPENDIX B

TYPICAL FILM INTRODUCTIONS AND DATA CODING SHEETS

General Introduction to Group

Ladies and Gentlemen; I am going to ask you to take part in an experiment this afternoon. The Bureau of Public Roads of the U. S. Department of Transportation and the Indiana State Highway Commission have asked Purdue University to study some of the aspects of the Highway Beautification problem.

As you know, a law was recently passed by the U. S. Congress relating to this question; the topic has also been a currently popular one for public debate and discussion. People have become conscious of the roadside environment and are concerned about it.

The study we are conducting at Purdue has to do with determining what people really do think of, and care about, the question of roadside appearance.

I am going to show you a color movie, a bit better than home movies, I hope, and ask you to view it. In looking at it I want you to try to imagine that you are actually out driving along the road and what you see is the road along which you are traveling.

Introduction to Billboard Film

The film is a color motion picture film of typical roadside views as are found throughout Indiana. These show the roadside as a passenger in an automobile would see it. What you will see is a short series of films, each individual film will be about 30 to 35 seconds long. In each one of these you will notice there are a number of outdoor advertising signs or billboards, the number will vary from very few to an extremely large number.

Now, what I am going to do is ask you to look at these films, which will be presented one at a time, and ask you to tell me what your reaction to them is or what you think of them. Further, I am going to ask you to use the sheet of paper that I have passed out to mark down your reactions to the films as you see them.

You will notice the two samples as illustrated on the sheet -- well, the method of recording your reaction is to circle, or cross, or check the position on the horizontal line that corresponds to your reaction to or opinion about each of film sections. You will notice the list of adjectives along the line, describing from extremely objectionable or disliking to extremely pleasant or interesting, with positions for moderately and slightly located towards the center and with a point of indifference or unconcern either way located in the middle of the line. This is ment to describe the type of reaction that you will have to each of the films you will be seeing.

Now, I am going to ask you to view the films and notice the billboards in each view. Try to ignore the slight differences in the

quality of the photography; rather, concentrate upon the presence of the billboards and what they do to your enjoyment of and appreciation of the views you see on the screen. Now in some there will be a large number of billboards, in others only a few.

As you view the film, think about what your reaction or opinion is, in terms of the choices you can make in recording them. There will be a short pause in the film after each section to allow you to record your reaction to the film. You may choose any position between and including the two ends of the line, just circle or check or cross the small tic or mark on the line that most nearly corresponds to or represents your own reaction.

Now, in order to better acquaint you with the film you will see and the type of choice you will need to make I am going to start the projector and show you four (4) film sections, as you view the film think about what your reaction is but do not record it.

(Pause here and start film, continue after showing first four film sections.)

Now you have seen a few samples of what the rest of the film is like. When I start it again you will see sections numbered 1 to 24. I want you to try to ignore the other differences, try to concentrate on the billboards and your reaction to them -- how they impress you, how they affect your enjoyment of the passing view and roadside, how they interest you or distract you -- try to imagine you are seeing them as if you were out driving along the highway yourself. How do the billboards affect you, in a positive way or a negative way or are you not affected by them at all or do you really notice them or care about them. Now record your responses on the corresponding line, using any

tic or mark on the line to represent your opinion including the ones between the various adjectives and those at the two ends of the line.

Before starting the film again I will answer any questions anyone may have if you are confused and then we will proceed with the film.

Remember now that the first four were only samples and you should start recording your answers with the first section and on the first numbered line in the sequence of twenty four.

(Pause here and start film, continue after showing complete film.)

Introduction to General Questionnaire

Now that you have seen this film, I would like to ask you to take a few more minutes of time and complete the questionnaire that I am now passing out to you. Please feel free to make any comments that you wish on either the film or the general subject, please write any comments on the reverse side of the last page of the questionnaire.

If there are any questions about completing the questionnaire, please feel free to ask me.

Introduction to Junkyard Film

(The basic introduction to the junkyard film contains the same general introduction used with the billboard film and the same introduction to the general questionnaire used with the billboard film. The only difference in the entire introductions used with the films is that difference between the specifics used for each film.)

The film is a color motion picture film of typical roadside views as are found throughout Indiana. These show the roadside as a passenger

in an automobile would see it. What you will see is a short series of films, each about 30 seconds long. In each one of these sections a junkyard will be seen -- in some it will be well hidden, in others it will be quite obvious and in still others it will be only partly visible. However, if you look for it, it will be there.

Now, what I am going to ask you to do is to look at these films, which will be presented in pairs, and ask you to tell me which one of the two in each pair you prefer.. I am also going to ask you to mark your choice on the sheet of paper that I have passed out.

You will notice the two samples as illustrated on the top of the page passed out; well, all that you need to do is check, circle, cross or in some other way indicate which of the two 'a' or 'b' you prefer.

Now, in order to better acquaint you with the film and the choice you will have to make, I am going to start the film and show you two sample pairs -- all that I want you to do is watch them and decide which of the pair in each sample you prefer. For these samples I am not going to ask you to record your preference.

The difficult portion of this is the basis upon which I want you to make your choice; try to ignore the slight differences in quality of photography, try to look at the films and see just the junkyards. What I really want is your reaction to the junkyards. You will notice that some of them are screened or hidden, while others are more obvious. It is on this basis that I want you to try to determine which you prefer.

As you are viewing the two parts, 'a' and 'b', of each pair, try to determine which you prefer or what your reaction is -- particularly as you are viewing the second one. The film will pause for a few seconds

after each pair to give you an opportunity to record your reaction as to which of the pair you prefer.

(Pause here and start the film, continue after showing first two sets or pairs.)

Now you have seen two samples, the film will start again with pair number one (1a and 1b) and run to pair number ten (10a and 10b). I want you to try to ignore the other differences and concentrate on each junkyard and decide which of the two you prefer in each pair. Base this choice on your own reaction to what you see of the junkyard. You may express any preference you wish including that for the junkyard that is more obvious or less obvious.

Before starting the film again I will answer any questions anyone may have if you are confused and then we will proceed with the film.

Remember that the first two pairs you saw were only samples and you should start recording your answers in the space numbered one and proceed to the space numbered ten.

(Pause here and complete showing the film, to the end of the series of ten pairs, then continue with introduction.)

Now that you have seen all of the pairs, I would like to ask you to tell me what you think about each individual film section as you view it. This time I want you to tell me if you are or are not offended by each junkyard, if you like or do not like each one, if you will or will not accept each one as it is shown or want something done with the junkyard, if it please or displease you. In short I want to know if you consider what you see good or bad.

To indicate your choice I will ask you to only mark those that you do like or that are good, acceptable, unobjectionalbe, etc. Now --

that is check or mark only those you like or are unobjectionable. I will start the film again and what you will see is a sequence of one (1) to five (5) film sections, presented singly, with a short pause after each section. These are numbered to correspond with the numbered blanks on your page.

(Pause here and complete the showing of the last portion of the film, then continue with the introduction.)

CODING SHEET: JUNKYARD FILM

The following are two samples of the correct method for recording your responses to each section of the film according to the instructions given.

Sample 1. __ a. ✓ b.

Sample 2. ✗ a. __ b.

1. __ a. __ b.
2. __ a. __ b.
3. __ a. __ b.
4. __ a. __ b.
5. __ a. __ b.
6. __ a. __ b.
7. __ a. __ b.
8. __ a. __ b.
9. __ a. __ b.
10. __ a. __ b.

1. ____
2. ____
3. ____
4. ____
5. ____

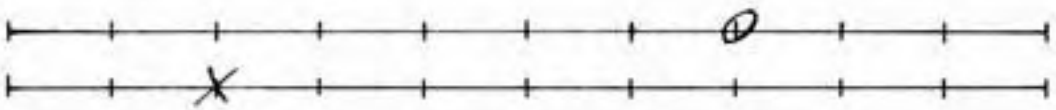
FIGURE B1. DATA COLLECTION AND CODING FORMS FOR USE WITH FILMS.

CODING SHEET: BILLBOARD FILM

The following are two samples of the correct method for recording your responses to each section of the film according to the instructions given.

Sample 1.

Sample 2.



Please indicate on the horizontal lines the extent to which you like or dislike, find unpleasant or pleasing, find objectionable or unobjectionable, are annoyed by or interested in each of the film sections on the bases of the instructions given with the introduction to this film.

DISLIKE	LIKE
ANNOYED	INTERESTED
UNPLEASANT	PLEASANT
OBJECTIONABLE	UNOBJECTIONABLE

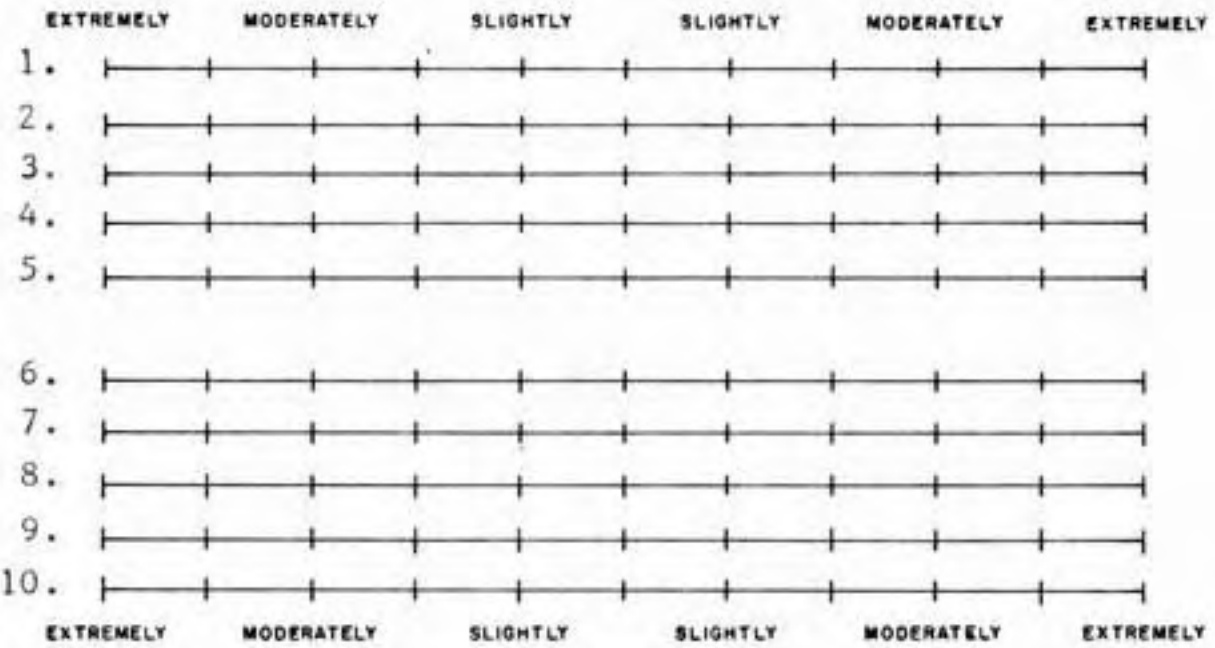


FIGURE B1. (Cont'd.)

DISLIKE
ANNOYED
UNPLEASANT
OBJECTIONABLE

LIKE
INTERESTED
PLEASANT
UNOBJECTIONABLE

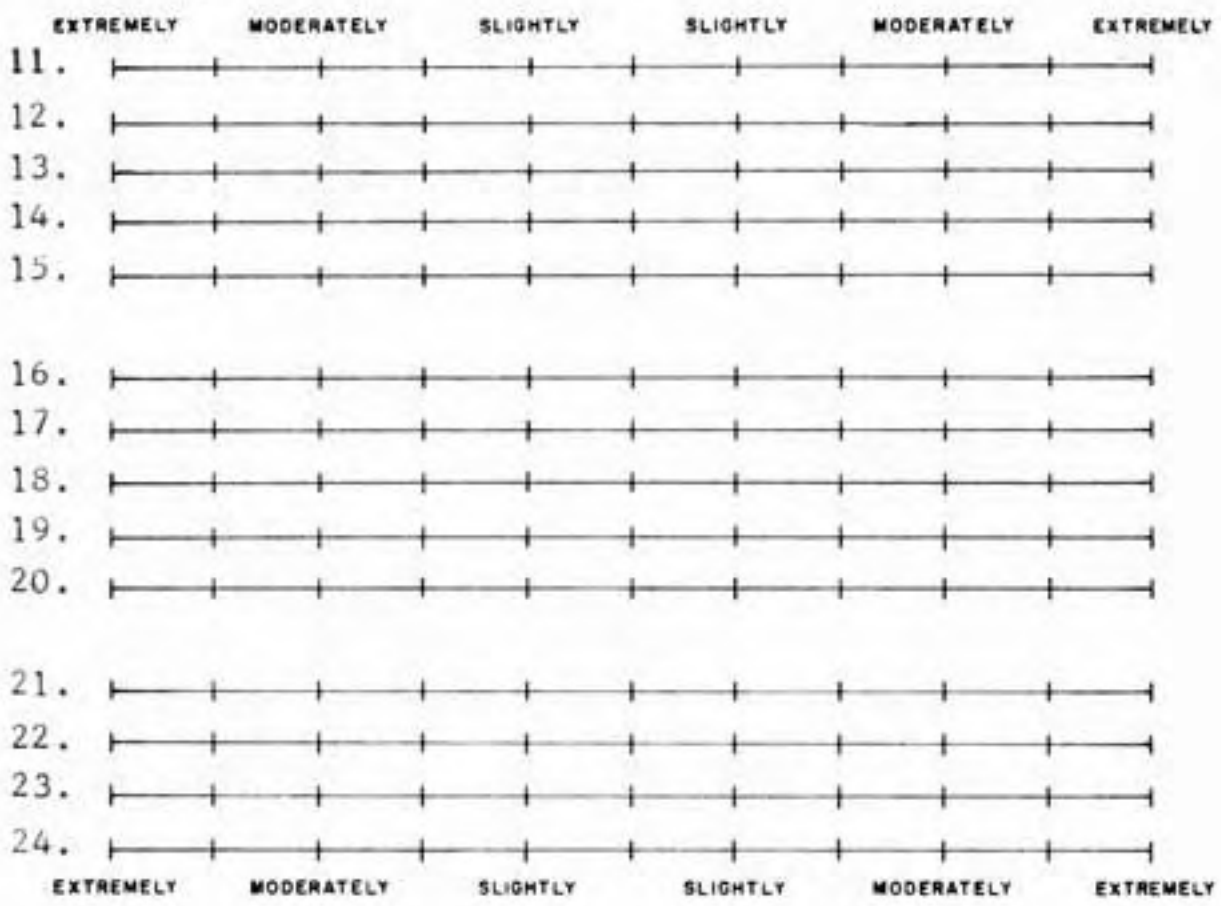


FIGURE B1. (Cont'd.)

PERSONAL INFORMATION FORM

Please complete the following personal information section of this questionnaire by checking the applicable blanks.

1. Age

__ less than 20	__ 36 to 40	__ 56 to 60
__ 21 to 25	__ 41 to 45	__ 61 to 65
__ 26 to 30	__ 46 to 50	__ 66 to 70
__ 31 to 35	__ 51 to 55	__ 71 or more

2. Sex ___ Male

___ Female

3. Marital Status

___ Single ___ Married ___ Widowed ___ Divorced

4. Please indicate the approximate range of your total family income by checking one of the blanks in the list below.

___ 0 to 5,000 per year

___ 5,000 to 7,500 per year

___ 7,500 to 10,000 per year

___ 10,000 to 15,000 per year

___ 15,000 to 25,000 per year

___ 25,000 or more per year

5. Indicate by number the number of cars principally garaged at your residence.

___ Cars

FIGURE B1. (Cont'd.)

6. Education (check the blank for the highest level attended)

   Never attended school ___

   Elementary school ___

   High School (year) ___ 10 ___ 11 ___ 12 ___ 13

   College (year) ___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6(+)

7. Do you presently hold a valid driver's license?

   ___ Yes ___ No

8. Please give a short description of the main activity of your company (eg. Bakery, Insurance, Auto Repair, etc.) in the space below.

   _____

9. Please give a short description of your occupation (eg. student, salesman, engineer, manager, accountant, executive, etc.) in the space below.

   _____

10. Please indicate the population (approximate) range of the community in which your residence is located.

    ___ less than 2,500
    ___ 2,500 to 4,999
    ___ 5,000 to 8,999
    ___ 9,000 to 14,999
    ___ 15,000 to 24,999
    ___ 25,000 to 49,999
    ___ 50,000 to 99,999
    ___ 100,000 to 199,999
    ___ 200,000 to 499,999
    ___ 500,000 or more

11. Please indicate the county and state of your residence.

    _____ county, _____ State

FIGURE B1. (Cont'd.)

TRAVEL INFORMATION FORM

1. Please indicate by numbers how many auto trips of 100 miles or more you have made with the last 12 months for business and pleasure.

   _____ Business _____ Pleasure

2. About how many miles did you drive during this same period of time?

   _____ Miles

3. Do you generally use the same brand of gasoline?

   ___ Yes ___No

4. Please indicate how many gasoline credit cards you have?

   _____ Credit Cards

5. Please indicate your meal preferences when travelling by placing an R(restaurant), C(cafeteria), CS(counter service), or P(picnic) in each space below.

   ____ Breakfast ____ Lunch ____ Dinner

6. How much do you spend daily, per adult, for each of your meals when travelling?

   ____ Breakfast ____ Lunch ____ Dinner

7. How much do you expect to pay for overnight accommodations per single room?

   _____ Dollars

8. Do you usually make prior reservations?

   ___ Yes ___ No

FIGURE B1. (Cont'd.)

9. The motorist on a freeway is usually alerted to the services available ahead by means of signs, billboards, and sometimes by actually sighting the service establishment such as a gasoline station or motel. Of the following types of information pertaining to the availability of services ahead please check the one that most nearly satisfies YOUR information needs.

__ Notification of: "SERVICES", or "SERVICES THIS EXIT", or "ROADSIDE BUSINESS".

__ Notification of Service Type: "GAS", "FOOD", "PHONE", "LODGINGS".

__ Services by Brand Name: "Standard", "Pure", "Shell", "Holiday Inn", "Howard Johnson".

__ Service Availability: "GAS 1 mi.", "OPEN 24 Hours", "NEXT SERVICES 15 miles".

10. Please indicate by 1, 2, 3, ... the order in which any or all of the following list below annoy you when travelling.

__ Confusing or inadequate signs

__ Billboards along highway

__ Lack of services along freeway (gas, food, lodging)

__ Unclean restrooms

__ Traffic

__ Inept or incompetent drivers

11. Please check the conveniences that you feel should be provided at roadside parking or rest areas.

__ Telephone

__ Restrooms

__ Night lighting

__ Overnight camping space

__ Drinking water

__ Picnic tables

__ Information aids (maps, guides, pamphlets)

FIGURE B1. (Cont'd.)

12. Please indicate by numbers 1, 2, 3, ... the order of importance to you of each of the following in choosing a place to have a meal when travelling (it is not necessary that every item in the list be numbered, only indicate those which are of importance to you):

BREAKFAST	LUNCH	DINNER
__Credit cards honored	__Credit cards honored	__Credit cards honored
__National advertising	__National advertising	__National advertising
__Recommended by someone	__Recommended by someone	__Recommended by someone
__Price	__Price	__Price
__Billboards	__Billboards	__Billboards
__Appearance (outside)	__Appearance (outside)	__Appearance (outside)
__Repeat visit	__Repeat visit	__Repeat visit
__Chain affiliation	__Chain affiliation	__Chain affiliation
__Guide book recommendation	__Guide book recommendation	__Guide book recommendation
__Other*	__Other*	__Other*

_____

_____

_____

*use space above to add to the lists if you wish or for any other comments

FIGURE B1. (Cont'd.)

13. Please indicate by numbers 1, 2, 3, ... the order of importance to you of each of the following in choosing accommodation when travelling (it is not necessary that every item in the list be numbered, only indicate those which are of importance to you):

TRAVEL FOR BUSINESS PURPOSES	VACATION AND RECREATION TRAVEL
__Credit cards honored	__Credit cards honored
__National advertising	__National advertising
__Recommended by someone	__Recommended by someone
__Price	__Price
__Billboards	__Billboards
__Appearance	__Appearance
__Repeat visit	__Repeat visit
__Chain affiliation	__Chain affiliation
__Guide book recommendation (eg. AAA Guide, etc.)	__Guide book recommendation (eg. AAA Guide, etc.)
__Other*	__Other*
_____	_____
_____	_____
_____	_____

*use space above to add anything to the list you wish and the space below or on the back of the page to make any comments you wish

Comments: _____

_____

_____

_____

_____

FIGURE B1. (Cont'd.)

APPENDIX C

COMPUTER PROGRAMS

14. What is the length of your annual vacation?

_____ days
weeks (indicate which)
months

15. Please check any of the following statements that you agree with:

___ Billboards are interesting along the highway

___ Junkyards are ugly sights along the highway

___ I rely on billboards to find services needed when travelling

___ Junkyards should be fenced in and planted so as to hide them from view from the road

___ All billboards should be removed from the roadside

___ I do not rely on billboards to find services needed when travelling

___ Billboards are ugly sights along the highway

___ Billboards should not be removed from the roadside

___ Junkyards are interesting sights along the highway

___ Billboards are necessary to provide information to the motorist

___ Junkyards should be removed from the roadside

___ Many billboards should be removed from the roadside

___ Junkyards should not be removed from the roadside

___ Billboards are not really needed to provide information to the motorist

___ Junkyards are not ugly sights along the highway

FIGURE B1. (Cont'd.)

16. Please complete the following sentences with just a few words.

a. Billboards are _____.

b. Junkyards are _____.

FIGURE B1. (Cont'd.)

APPENDIX C

COMPUTER PROGRAMS

Psychological Scaling Program

A complete program was prepared to perform the analysis based upon the outline presented. A single program was prepared in order to use a set of subroutines that performs a set of functions common to both basic techniques. The program is also designed to be flexible in terms of the input format it will accept. The user may specify the input format at execution time. He must also supply certain control data to the program. Figure C1 is the flow chart for the program and shows the order in which all the steps fit to form one basic package for the solution of pair comparison and successive category problems.

Figure C2 is a listing of the program itself; it is written in the FORTRAN IV programing language in such a manner that it will run on any of the IBM 7090/94, IBM S360, or CDC 6000 series computers -- provided they are equipped with a FORTRAN compiler. The user must make only the noted change in the arcsine function in the program when switching from IBM to CDC equipment (two program locations only) or he must convert to BCD codes for the S360 if using such a machine. The user must also supply his own file routines and account coding information (if needed) according to the center and machine that he is using. The illustration

here is for application on an IBM 7090/94 and uses an intermediate file for data storage, this feature means that data may be prepared for a separate input file if the user wishes.

The required control card information and correct control card format are indicated in Table C1 for the analysis of pair comparison problems and in Table C2 for the analysis of successive categories problems. There is no limit to the number of problems that may be processed in one run and the two types of problems may be run at the same time using only the correct control cards for each. The maximum problem size is fixed by the size of the control card parameters -- these may be altered by the user if desired.

The program contains built in features for determinning probabilities and deviates from a normal distribution when given one and in need of the other. The subroutines that solve pair comparison problems are also designed to take, as an input, dichotomous judgements for the purpose of absolute scaling in order to locate a zero point for the scale derived by the pair comparison analysis. If this feature is not desired by the user it will be necessary to make revisions in order to eliminate it from the program or to skip that part of the program. As presently written, this is not an available option in the program. Such a feature as an option could be added to the program and one of the blank fields on the PAIR card could be used for this purpose if desired. Data deck preparation is shown in Table C3.

Indiana State Highway Commission Inventories

The junkyard and billboard inventories collected by the Indiana State Highway Commission, as previously referred to, were summarized on an

IBM 7094 computer. The systems flow chart for this work is shown in Figure C3 for the two inventories. The data coding for these inventories is summarized in Tables C4 and C5. The punched card format is shown in Figure 1 in previous parts of this report. This program made use of an optional feature of the IBSYS Control System to skip data cards containing mispunched information (eg. alpha character in a numeric field), this problem was encountered on 4 of the approximately 54,000 data cards processed. Each inventory was separately summarized and is given in Appendix A.

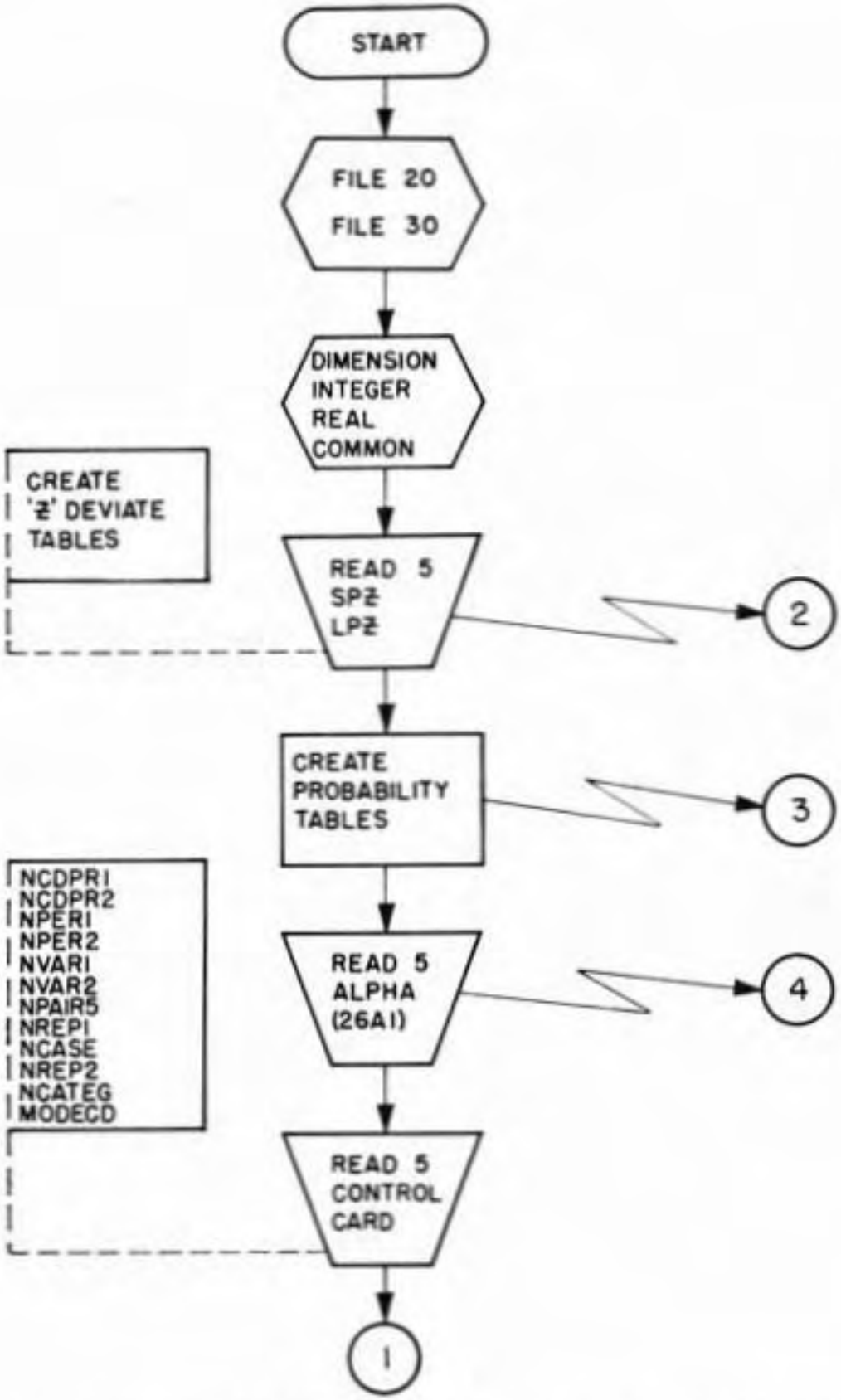


FIGURE C1. COMPUTER PROGRAM FLOW CHARTS. PSYCHOLOGICAL SCALING PROGRAM.

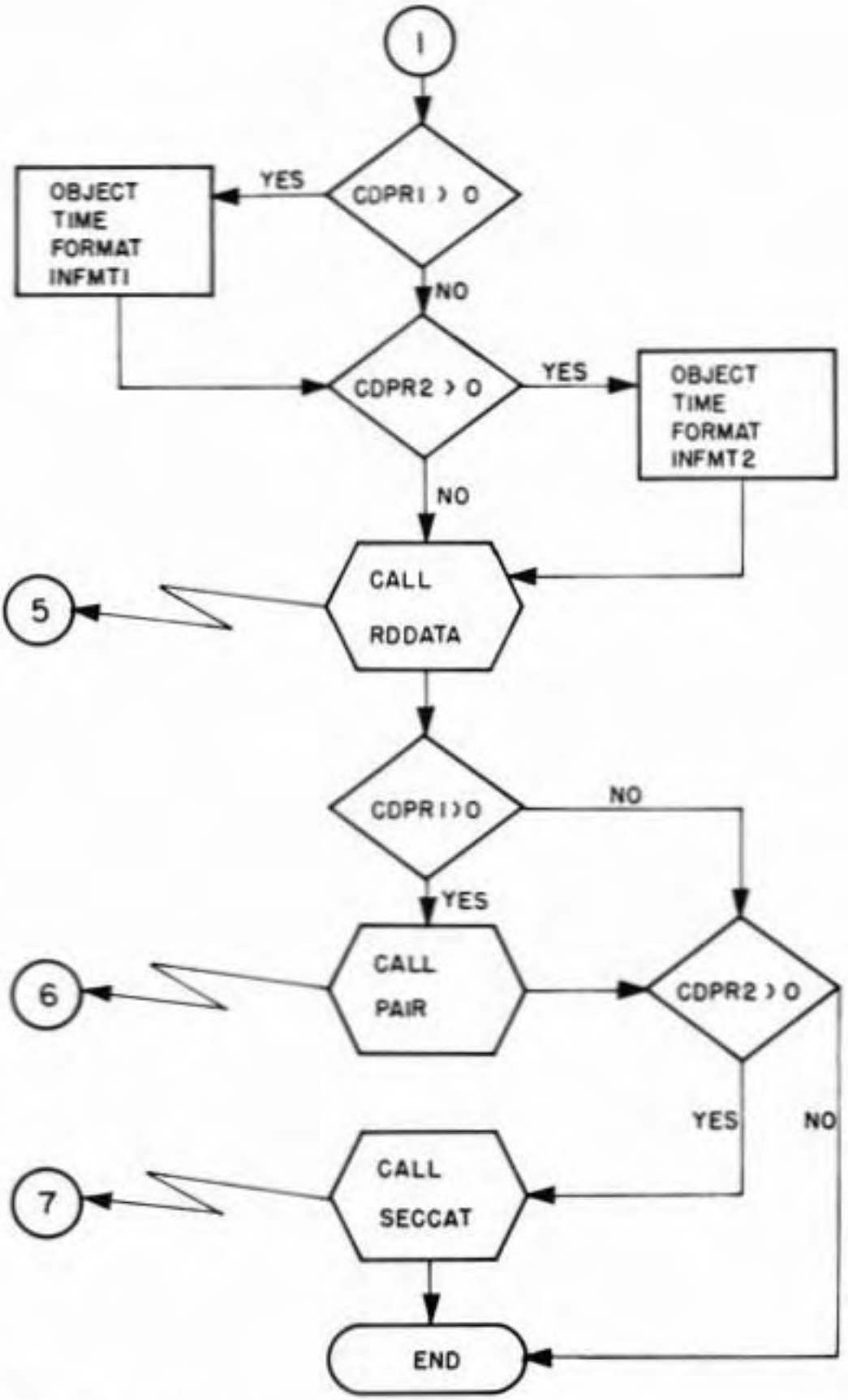


FIGURE C1. (Cont'd.)

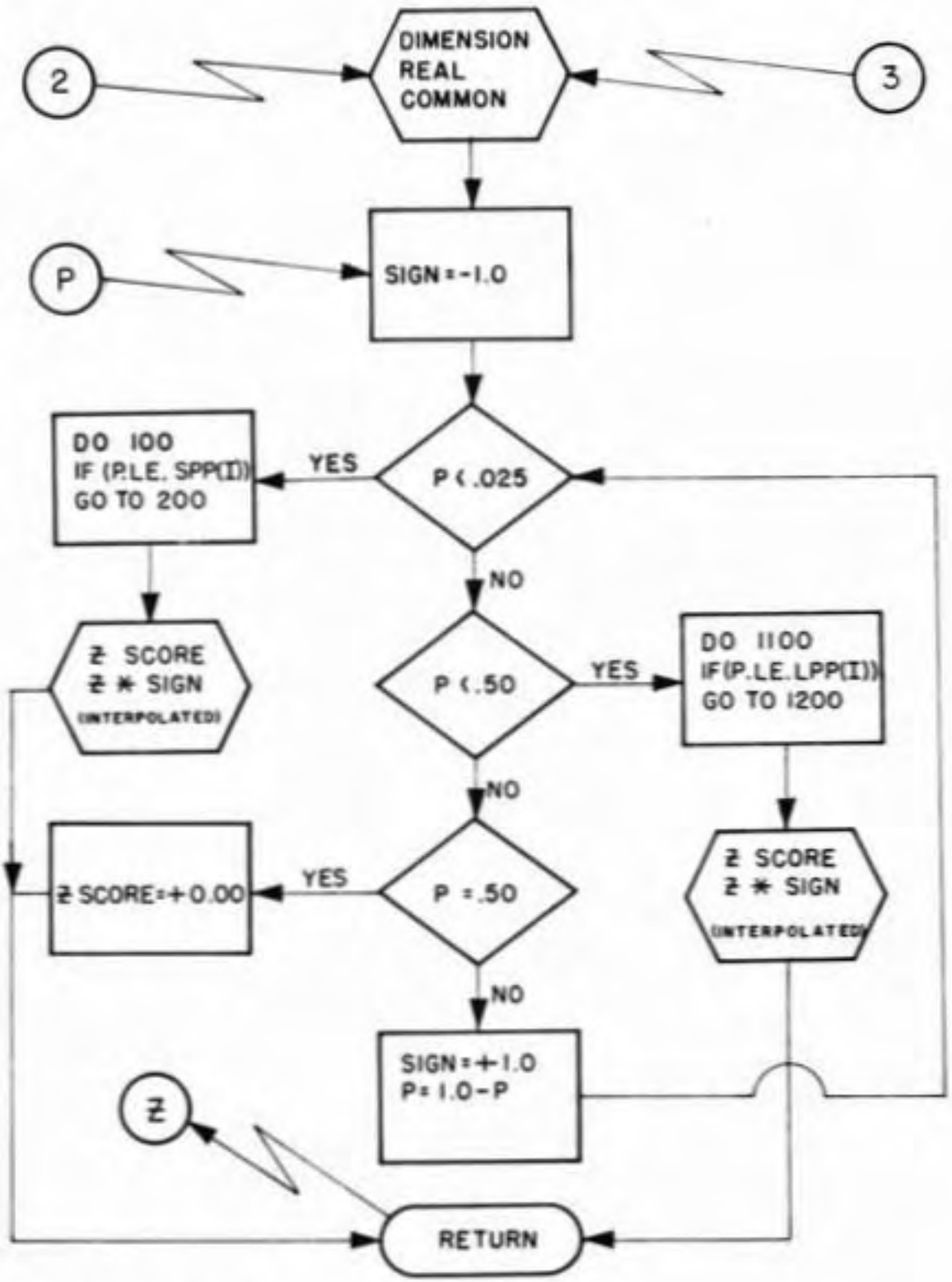


FIGURE C1. (Cont'd.)

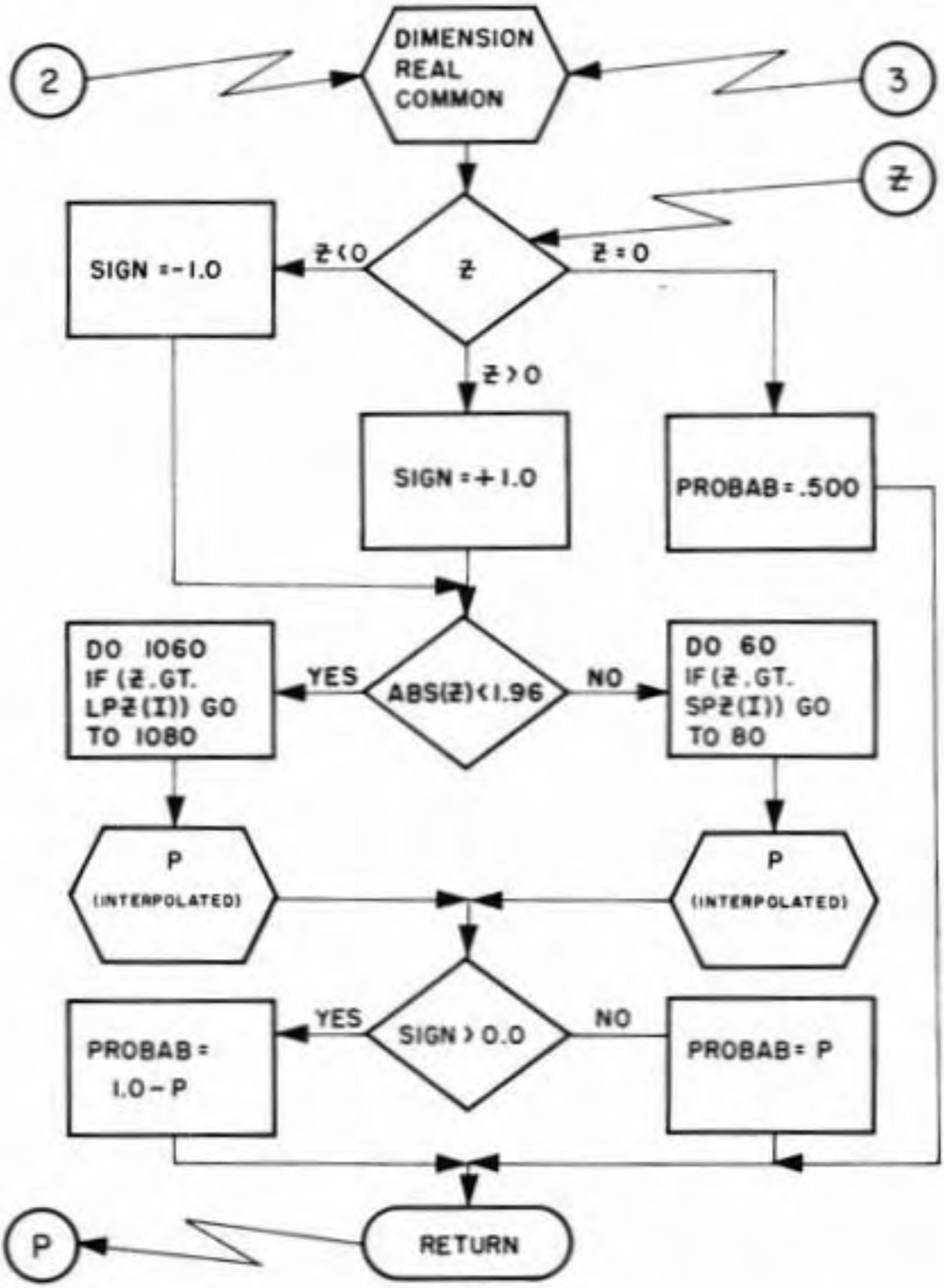


FIGURE C1. (Cont'd.)

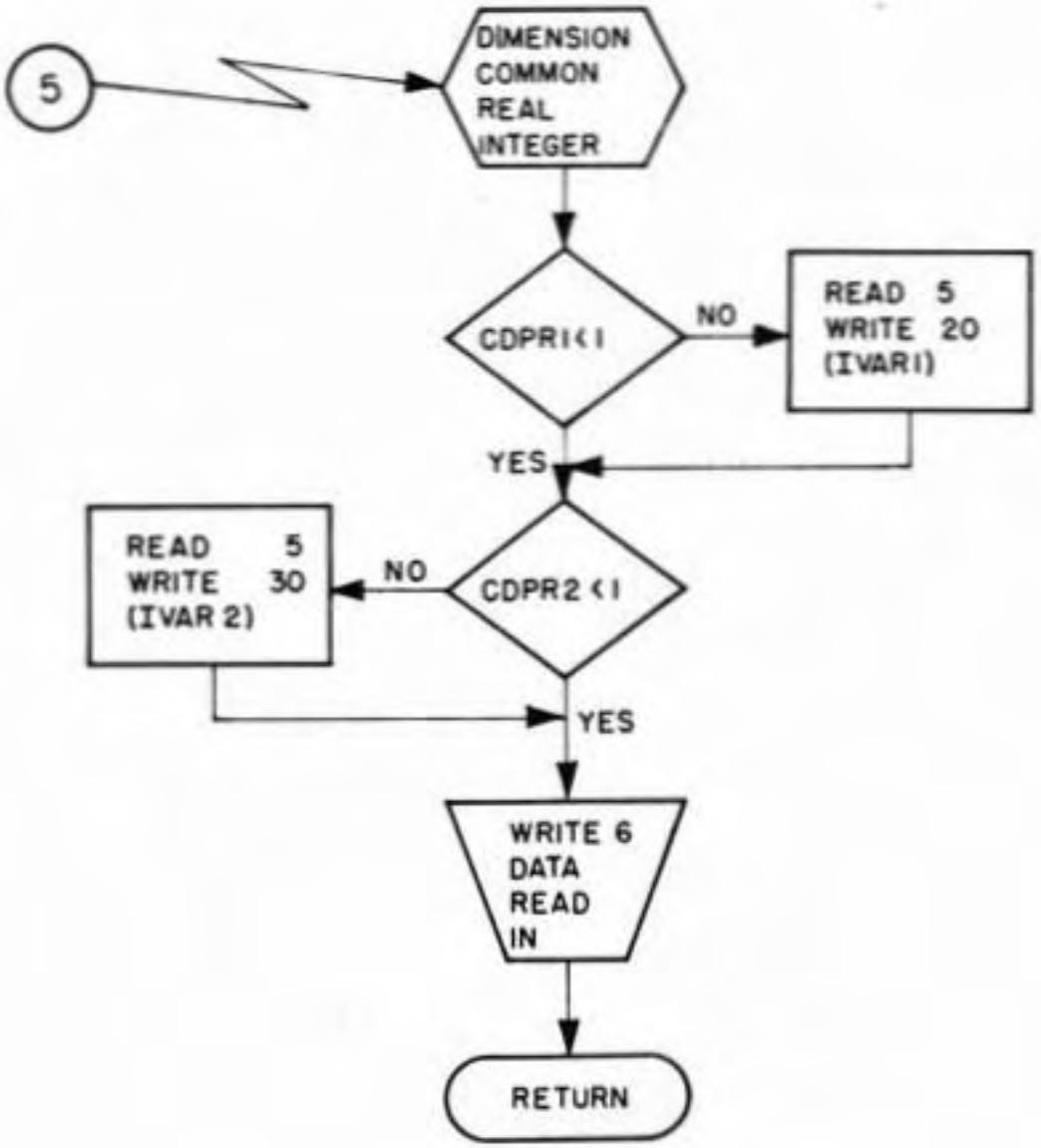


FIGURE C1. (Cont'd.)

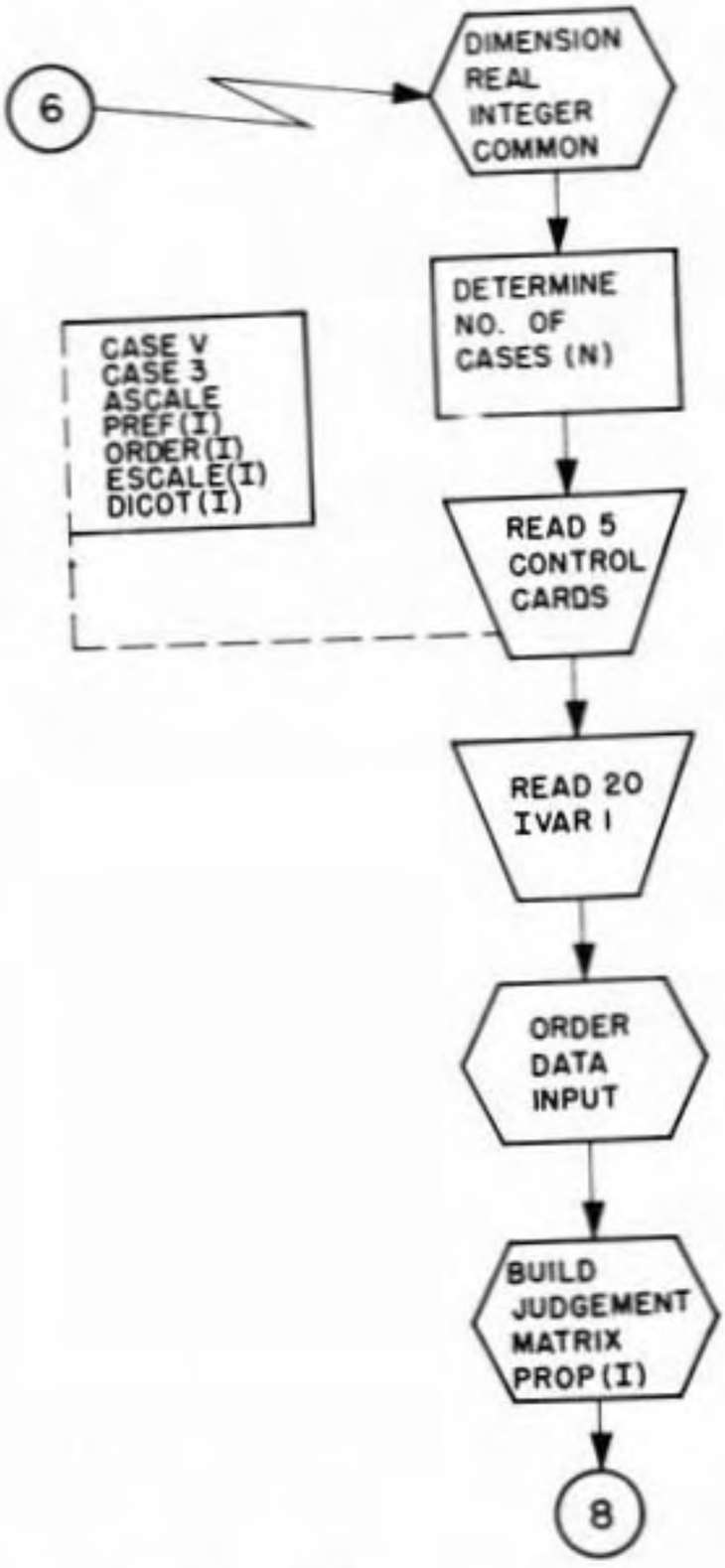


FIGURE C1. (Cont'd.)

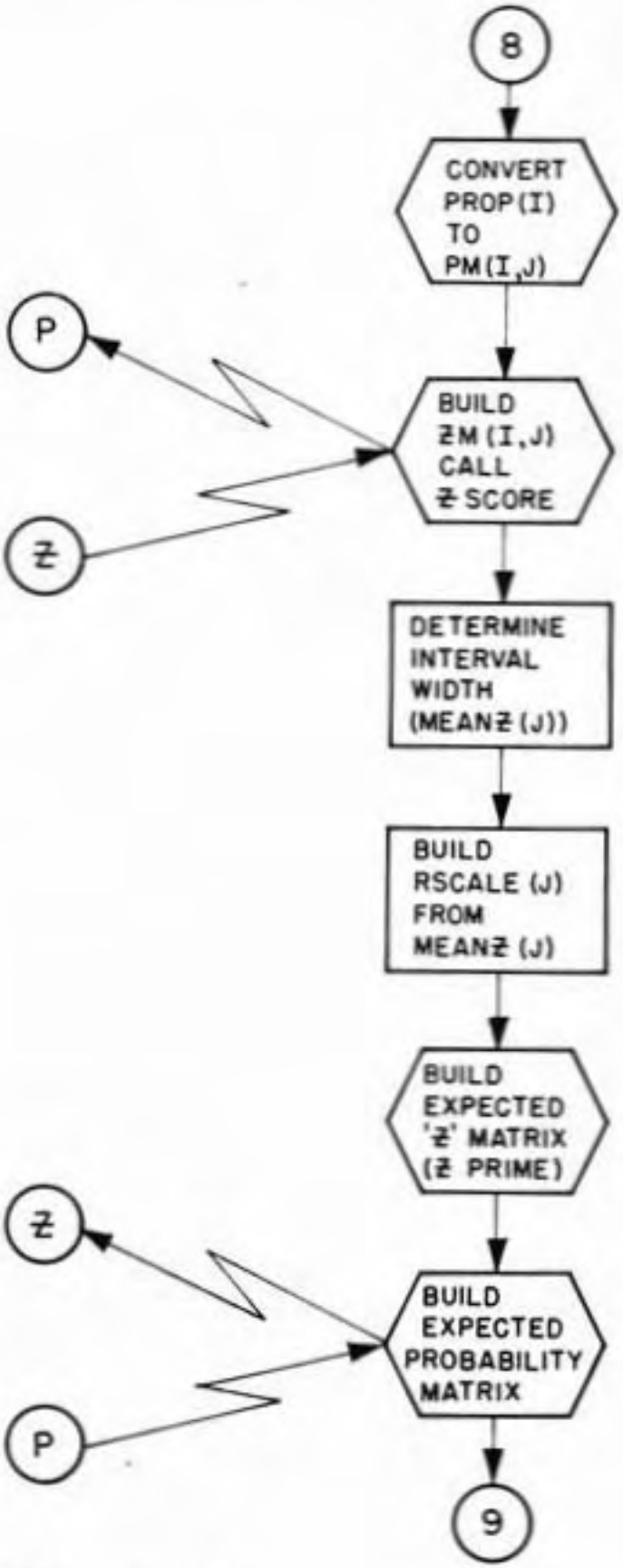


FIGURE C1. (Cont'd.)

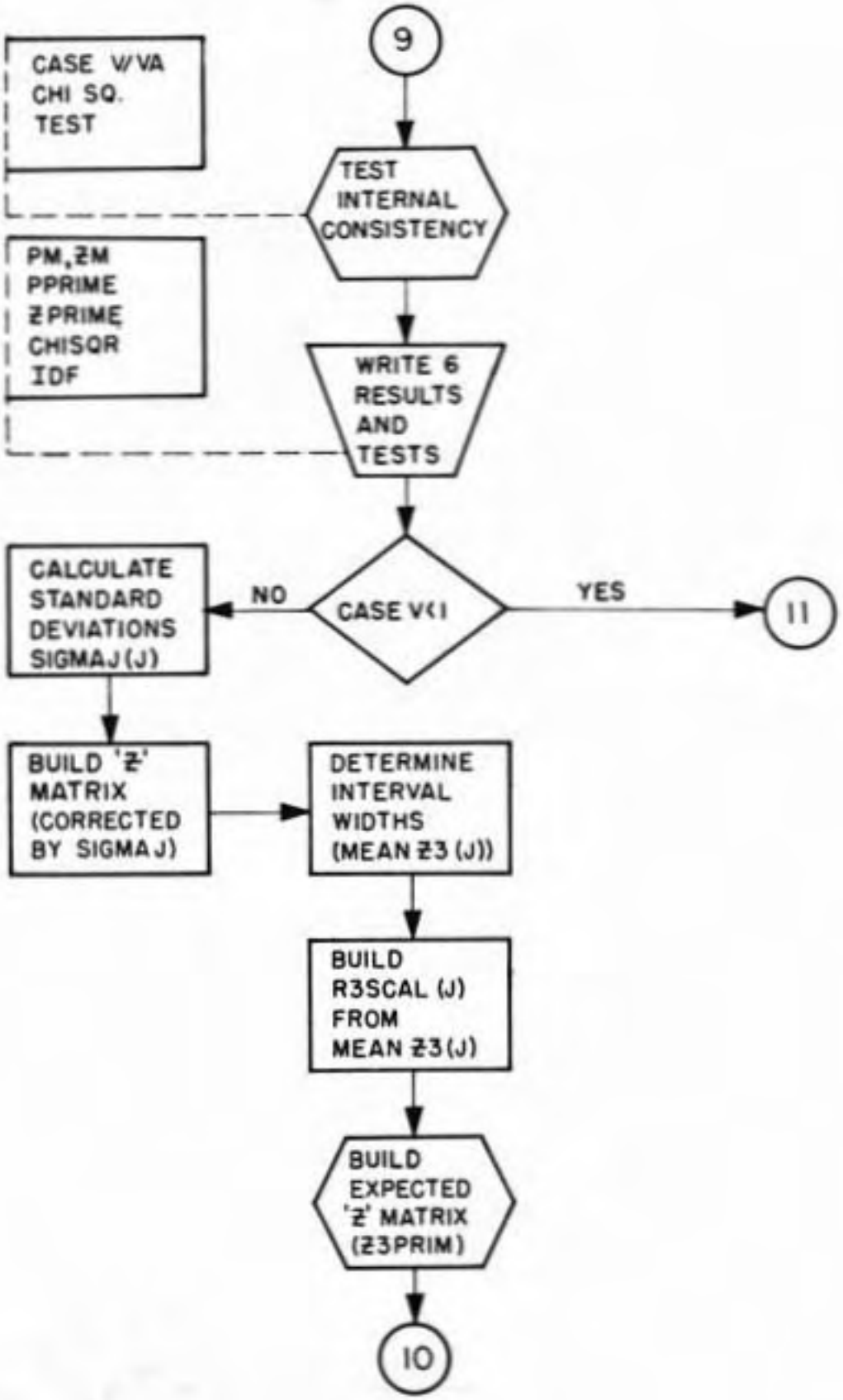


FIGURE C1. (Cont'd.)

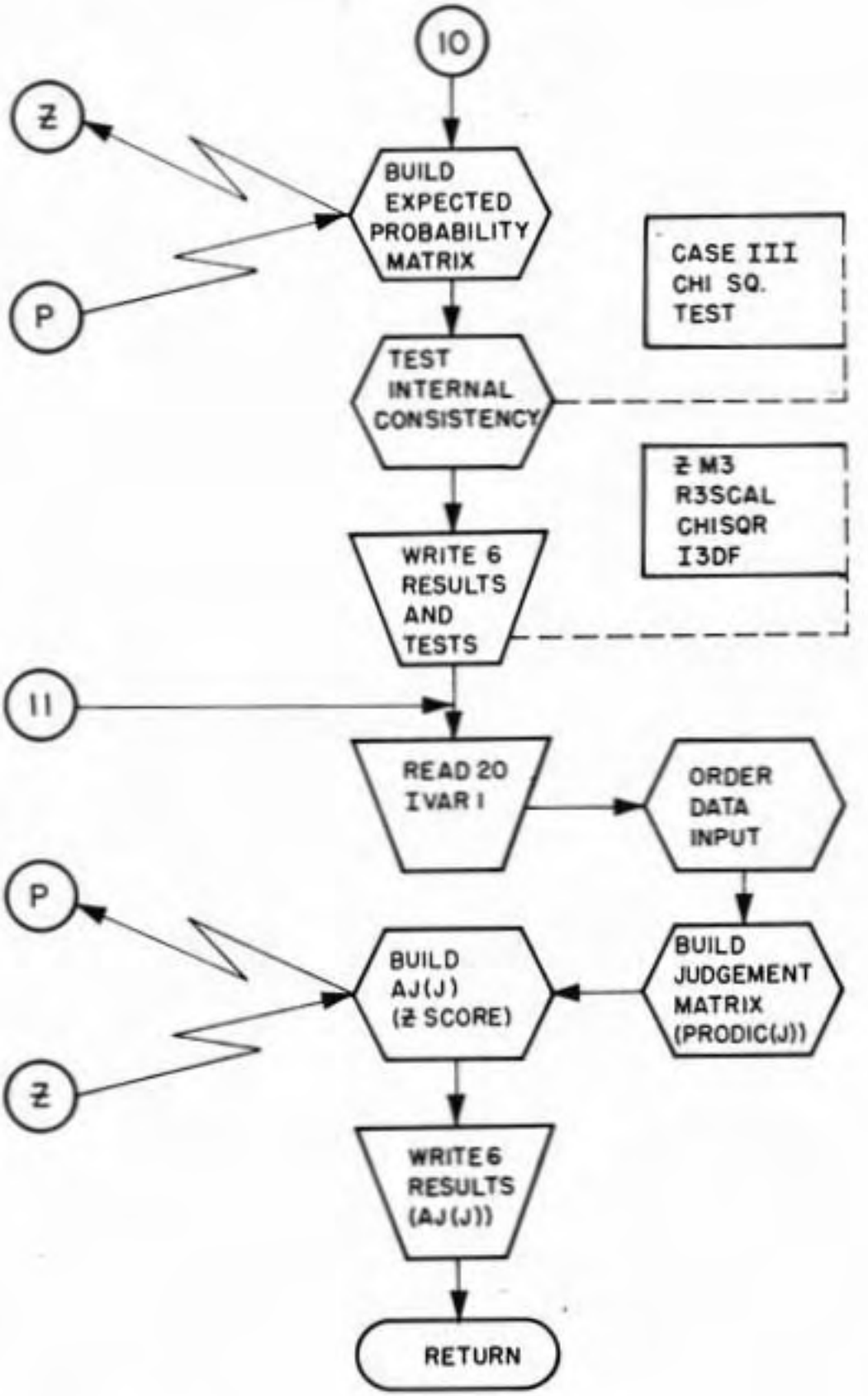


FIGURE C1. (Cont'd.)

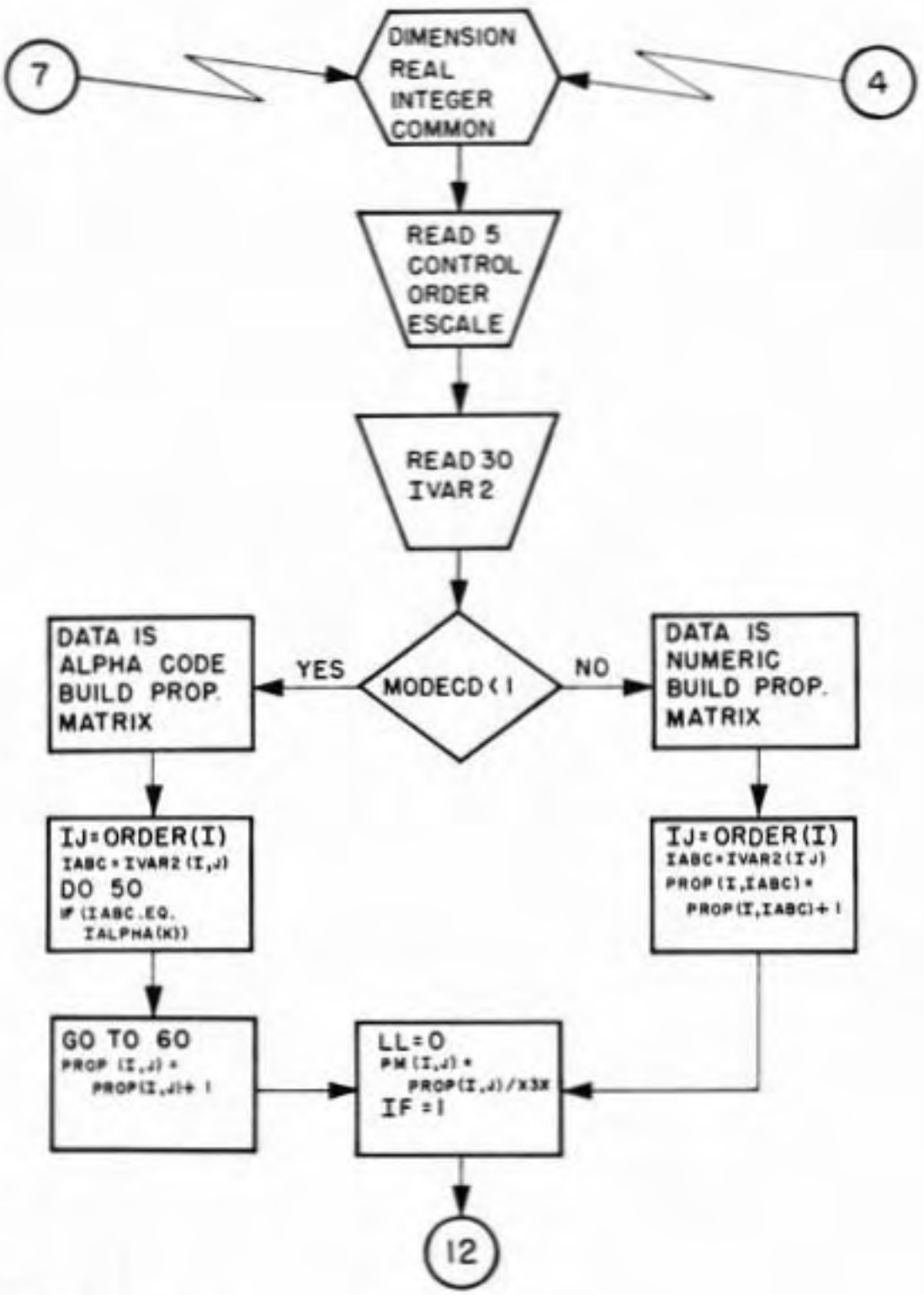


FIGURE C1. (Cont'd.)

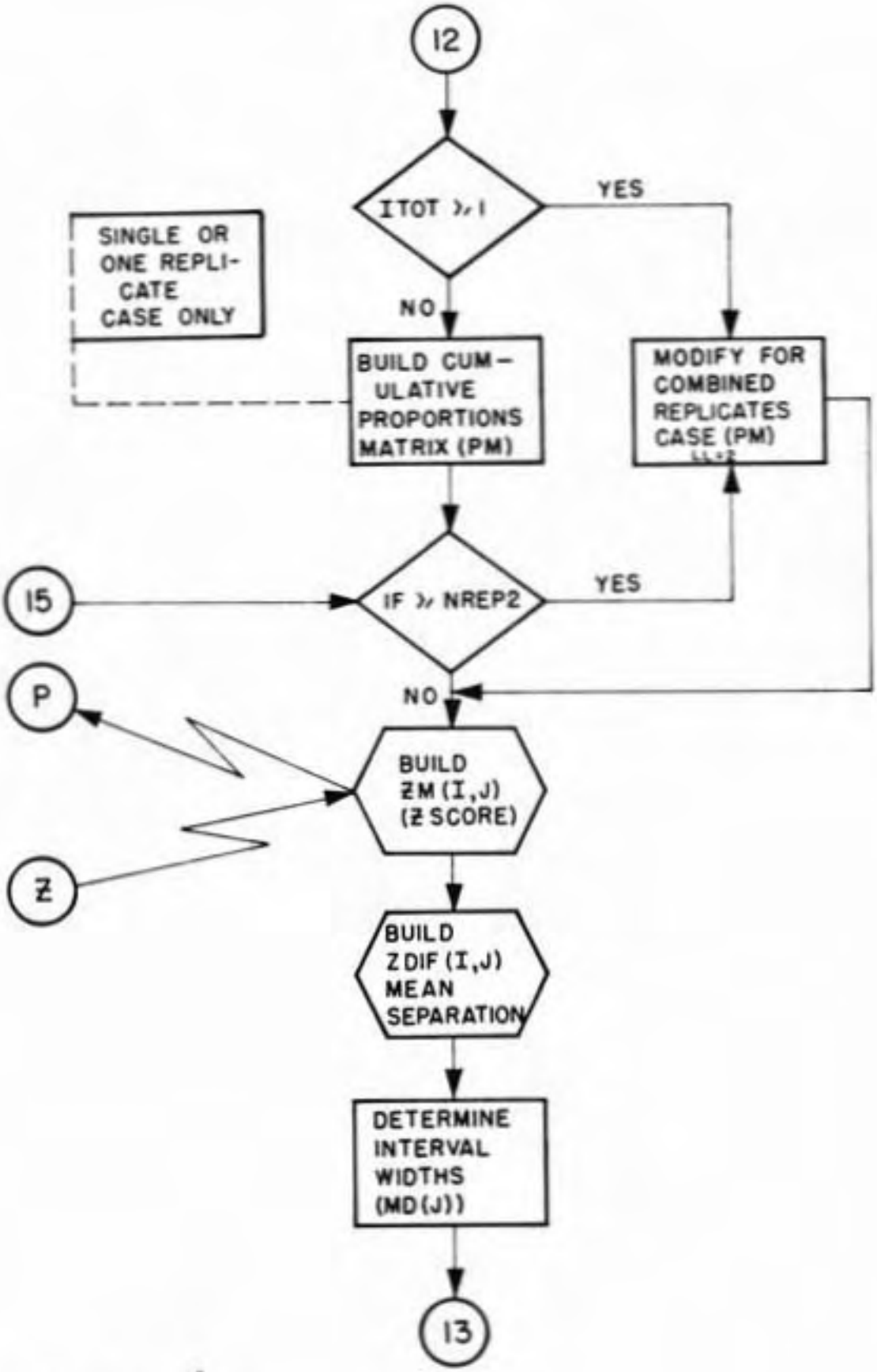


FIGURE C1. (Cont'd.)

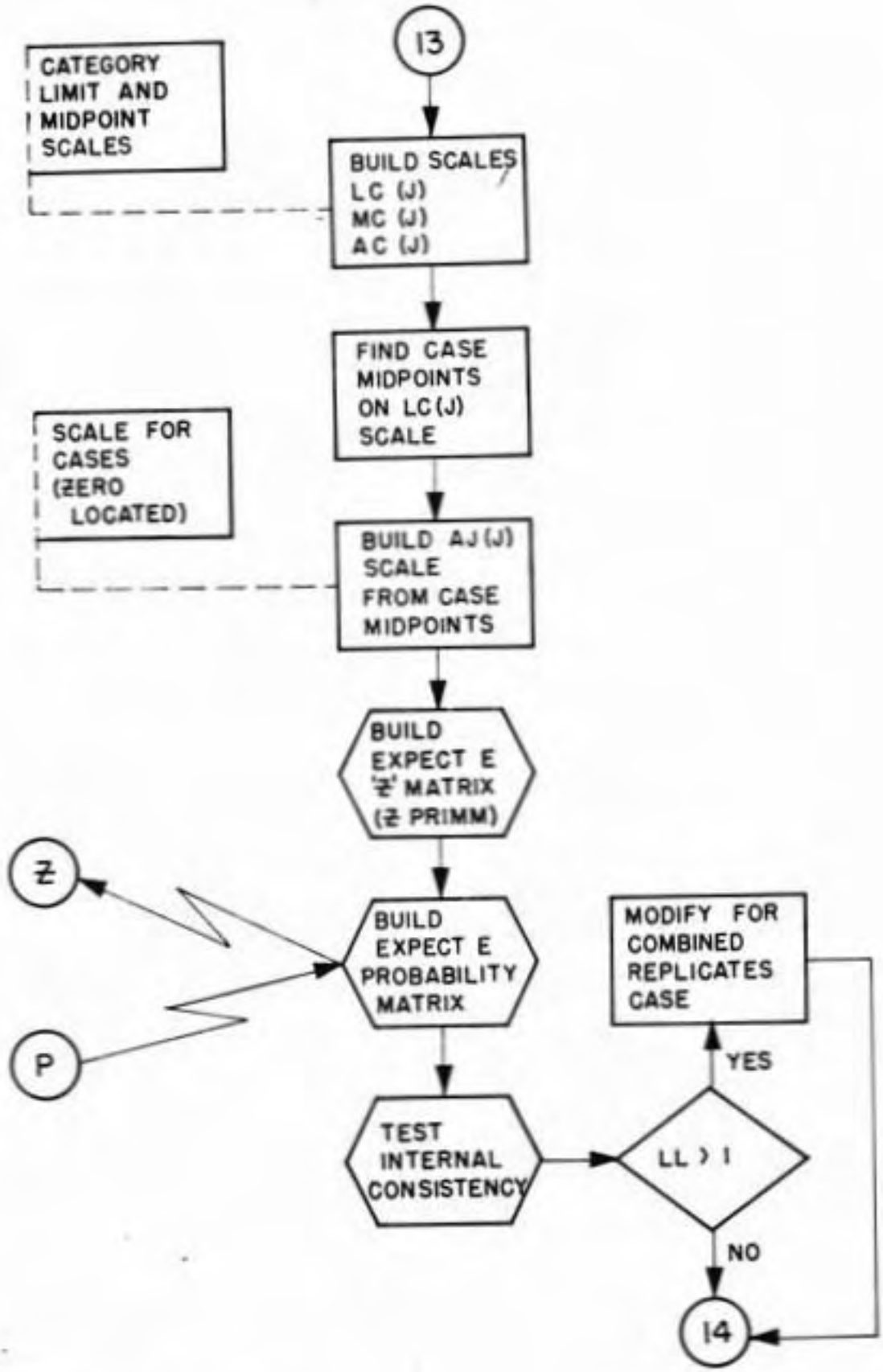


FIGURE C1. (Cont'd.)

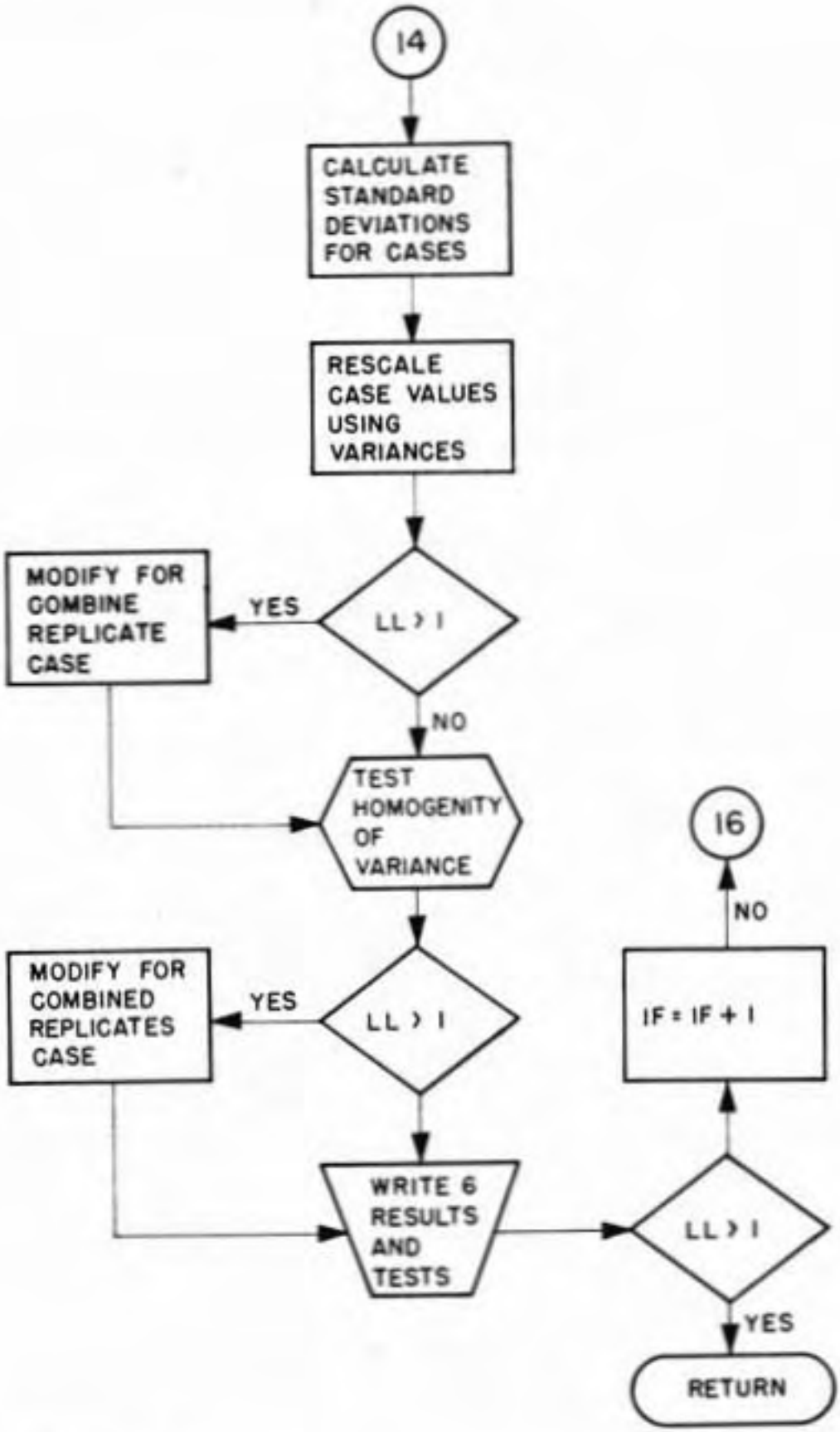


FIGURE C1. (Cont'd.)

```
$JCY
$ID
$IBSYS
$ATTACH         COMDFO
$FS             SYSUT3,DSK,SYS,DC
$ATTACH         COMIFO
$FS             SYSUT4,DSK,SYS,DC
$ATTACH         A1
$FS             SYSUT5,LOW
$ATTACH         B4
$FS             SYSUT6,LOW
$IBSYS
$EXECUTE        IBJOB
$IBJOB          MAP
$IBMAP FILE1    ,NODECK,NOLIST
       ENTRY    ,JN20.
,LN20. PZE      UNIT20
UNIT20 FILE     ,DTS,READY,INOUT,BLK=1CO,LOW,BCD,NOLIST,SCRATCH
       END
$IBMAP FILE2    ,NODECK,NOLIST
       ENTRY    ,JN30.
,LN30. PZE      UNIT30
UNIT30 FILE     ,DT6,READY,INOUT,BLK=1CO,LOW,BCD,NOLIST,SCRATCH
       END
$IBFTC JNAPI
      REAL LPZ,LPP
      INTEGER COPR1,COPR2
      DIMENSION SPZ(2501),SPP(2501),LPZ(481),LPP(481),INFMT1(60),
     1INFMT2(60),ALPHA(26),TITLE(12)
      COMMON SPZ,SPP,LPZ,LPP/B1/INFMT1,INFMT2,NCOPR1,NCOPR2,NPER1,
     1NPER2 /B2/ALPHA,TITLE
```

FIGURE C2. COMPUTER PROGRAMS, PSYCHOLOGICAL SCALING ANALYSIS.

```
C CREATES TABLES FOR F SCORE AND PROBABILITY LOOK-UPS
      READ(5,1001)(PF(I),I=1,250)
      READ(5,1001)(PF(I),I=1,9811
 1001 FORMAT(5F10.5)
      SPF(1)=0.0
      DO 1002 I=2,250
      SPF(I)=SPF(I-1) + .0001
 1002 CONTINUE
      PP(1)=.020
      DO 1003 I=2,49)
      PP(I)=PP(I-1) + .001
 1003 CONTINUE
      READ(5,1005)(ALPHA(I),I=1,26)
 1005 FORMAT(26A1)
C OBJECT TIME FORMAT AND ANALYSIS CONTROL FOR DATA SUBMITTED
 1010 CONTINUE
      READ(5,2002)(IBITS(I),I=1,12)
      READ(5,2003) NCPR1,NCPR2,NPER,NPER2,NAR1,NVAR2,NPAIRS,NREP1,
     1NCAT,NREP2,NCATEG,MODECD
 2001 FORMAT(1H0,11,4X,11,4X,11,3X,11,3X,11,3X,11,3X,11,3X,11,3X,11,3X,
     1I3,12,3I1
      IF(NCOPR1.LT.1) GO TO 2003
      IZZ=NCEPR1+2
      READ(5,2002)(INFMT1(I),I=1,IZZ)
 2002 FORMAT(132A1)
 2003 CONTINUE
      IF(NCOPR2.LT.1) GO TO 2004
      IZZ=NCEPR2+2
      READ(5,2002)(INFMT2(J),J=1,IZZ)
 2004 IF(NCEPR1.LT.1).AND.(NCOPR2.LT.1)) GO TO 2008
      IF(NCEPR1.GT.51.OR.NCOPR2.GT.51) GO TO 2005
      GO TO 2010
C ERROR MESSAGE AND STOP
 2005 CONTINUE
      WRITE(6,2006)
 2006 FORMAT(1H1,47HMORE THAN 5 VARIABLE INPUT FORMAT CARDS PER PROGRAM
     1ARE NOT ALLOWED !
      STOP
 2008 CONTINUE
      WRITE(6,2007)
 2007 FORMAT(1H1,50HNO VARIABLE FORMAT CARDS SPECIFIED ON PROGRAM CONTRO
     1L CARD !
      STOP
 2010 CONTINUE
      IF(NCOPR1.LT.1) GO TO 2030
      IF(NPER1.LT.1).OR.(NVAR1.LT.1)) GO TO 3010
      IF(NPAIRS.LT.1).OR.(NREP1.LT.1)) GO TO 3020
 2030 CONTINUE
      IF(NCOPR2.LT.1) GO TO 4000
      IF(NPER2.LT.1).OR.(NVAR2.LT.1)) GO TO 3010
      IF(NCATEG.LT.1).OR.(NREP2.LT.1)) GO TO 3020
 4000 CONTINUE
      IF(NPER1.GT.1000).OR.(NPER2.GT.1000)) GO TO 3030
      IF(NVAR1.GT.100).OR.(NVAR2.GT.100)) GO TO 3040
      IF(NPAIRS.GT.100).OR.(NCATEG.GT.100)) GO TO 3050
      IF(NREP1.GT.51.OR.(NREP2.GT.51)) GO TO 3060
      GO TO 4001
 3010 WRITE(6,3011)
 3011 FORMAT(1H1,41HNO. OF PERSONS OR VARIABLES NOT SPECIFIED !
      STOP
 3020 WRITE(6,3021)
```

FIGURE C2. (Cont'd.)

```
 3021 FORMAT(1H1,62HNO. OF RESPONSES PER PERSON OR NO. OF REPLICATES NOT
     1SPECIFIED )
      STOP
 3030 WRITE(6,3031)
 3031 FORMAT(1H1,27HNO. OF PERSONS EXCEEDS 1000 )
      STOP
 3040 WRITE(6,3041)
 3041 FORMAT(1H1,28HNO. OF VARIABLES EXCEEDS 100 )
      STOP
 3050 WRITE(6,3051)
 3051 FORMAT(1H1,28HNO. OF RESPONSES EXCEEDS 100 )
      STOP
 3060 WRITE(6,3061)
 3061 FORMAT(1H1,27HNO. OF REPLICATES EXCEEDS 5 )
      STOP
 4001 CONTINUE
      CALL ALLOCATE(NVAR1,NVAR2)
C     CALL ANALYSIS PROGRAMS
      IF(NCOPR1.GT.0) CALL PAIREVPAIRS,NREP1,INFMT1,NCOPR1,NVAR1,NPER1)
      IF(NCOPR2.GT.0)CALL SECCATE(INFMT2,NCASE,NREP2,NCATEG,NPER2,MODECD,
     * NVAR2)
      READ(5,4005)LAST
 4005 FORMAT(I2)
      IF(LAST.EQ.99) GO TO 4010
      GO TO 1010
 4010 CONTINUE
      RETURN
      END
$IBFTC SUB01
      SUBROUTINE ALLOCATE(NVAR1,NVAR2)
      DIMENSION INFMT1(600),INFMT2(600),IVAR1(100),IVAR2(100)
      COMMON /BLK/INFMT1,INFMT2,NCOPR1,NCOPR2,NPER1,NPER2
      EQUIVALENCE (IVAR1,IVAR2)
      REWIND 20
      REWIND 30
      IF(NCOPR1.LT.1) GO TO 200
      DO 101 I=1,NPER1
      READ(5,INFMT1)(IVAR1(J),J=1,NVAR1)
      WRITE(20,INFMT1)(IVAR1(J),J=1,NVAR1)
  101 CONTINUE
  200 CONTINUE
      IF(NCOPR2.LT.1) GO TO 300
      DO 201 I=1,NPER2
      READ(5,INFMT2)(IVAR2(K),K=1,NVAR2)
      WRITE(30,INFMT2)(IVAR2(K),K=1,NVAR2)
  201 CONTINUE
  300 CONTINUE
      REWIND 20
      REWIND 30
      WRITE(6,301)
  301 FORMAT(1H0,72HDATA READ FROM INPUT AND PLACED IN FILES 20 AND/OR 3
     10 FOR USE BY PROGRAM )
      RETURN
      END
$IBFTC SUB02
      SUBROUTINE PAIRS(NPAIRS,NREP1,INFMT1,NCOPR1,NVAR1,NPER1)
      DIMENSION PREF(100),ORDER(100),ESCALE(15),DICOT(15),KOUNT(100),
     1PROP(100),JUDGME(100),IVAR1E(100),PM(15,15),ZM(15,15),COVSP(15),
     2SUM(15),MEANJ(15),ZPRIME(15,15),PPRIME(15,15),RSCALE(15),
     3DIFTAP(15,15),VARZJ(15),SIGMAJ(15),THETA(15,15),ZM3(15,15),
     4COVSM3(15),SJM3E(15),MEANZ3(15),R3SCAL(15),P3PRIME(15,15),
```

FIGURE C2. (Cont'd.)

```
     1Z3PRIM(15,15),THETAP(15,15),PROJDC(15),COUDC(15),DIC(15),AJ(15),
     2INFMT(80),AXYZ(25),IALPHA(26),ITITLE(2)
      INTEGER CASE3,CASEV,ASCALE,ESCALE,PREF,ORDER,JUDGE,COUDC,DIC
      REAL MEANZ,MEANZ3
      COMMON /BZ/ IALPHA,ITITLE
      COMMON /B3/ESCALE,PM,ZM,COUSM,SLM,MEANZ,ZPRIME,PPRIME,ASCALE,
     1THETAP,VARZJ,SIGMAJ,THETA,ZM3,COUSM3,SUM3,MEANZ3,A3SCAL,
     2Z3PRIM,Z3PRIM,THETAP,PROJDC,COUDC,DIC,AJ,AXYZ
      READ(5,10) CASEV,CASE3,ASCALE,(PREF(I),ORDER(I),I=1,NPAIRS)
   10 FORMAT(5X,311,2X,14(12,1X,11,1X))
      IF(ASCALE.EQ.1) GO TO 20
      GO TO 30
   20 CONTINUE
      READ(5,21)(ESCALE(I),I=1,N)
   21 FORMAT(5X,10I5)
   30 CONTINUE
      READ(5,22)(DICOT(I),I=1,N)
   22 FORMAT(10X,10I2)
 1000 CONTINUE
      DO 31 I=1,NPAIRS
      KOUNT(I)=0
   31 PROPII)=0.0
      DO 100 I=1,NPERS
      READ(20,INFMT)(VAR(IJ),J=1,VVAR)
      DO 121 KK=1,NREPI
      DO 120 K=1,NN
      JJ=PREF(K)
      JUDGEM(K)=IVAR(JJ)
      IF(JUDGEM(K).LT.1) GO TO 99
      IF(JUDGEM(K).GT.2) GO TO 99
      IF(ORDER(K).LT.1) GO TO 120
      II=JUDGEM(K)
      GO TO (111,113),II
  111 JUDGEM(K)=2
      GO TO 120
  113 JUDGEM(K)=1
      GO TO 120
   99 KOUNT(K)=KOUNT(K)+1
  120 CONTINUE
  121 CONTINUE
      DO 231 III=1,N
      DO 231 JJJ=1,N
  231 PM(III,JJJ)=0.00
      DO 301 K=1,NREPI
      DO 300 J=1,NN
      KAK=JJ(JUDGEM(J) -1
      PROPIJJ=PROPIJJ + KAK
  300 CONTINUE
  301 CONTINUE
  100 CONTINUE
      DO 321 II=1,NREPI
      DO 320 I=1,NN
      AYZ=(NPERS*NREPII-KOUNT(I)
      PROPII)=PROPII)/AYZ
  320 CONTINUE
```

FIGURE C2. (Cont'd.)

```
321 CONTINUE
    IN=0
    DO 330 I=1,N
    IJ=I+1
    IF(IJ.GT.N) GO TO 330
    DO 329 J=IJ,N
    IN=IN+1
    PW(I,J)=1.0 - PROP(IN)
329 CONTINUE
330 CONTINUE
    DO 332 I=1,N
    PW(I,I)=.5000
332 CONTINUE
    DO 334 J=1,N
    JI=J+1
    IF(JI.GT.N) GO TO 334
    DO 333 I=JI,N
    PW(I,J)=1.-PW(J,I)
333 CONTINUE
334 CONTINUE
    DO 341 J=1,N
    DO 340 K=1,N
    ZW(J,K)=ZSCORE(PW(J,K))
340 CONTINUE
341 CONTINUE
    DO 350 I=1,N
    DO 350 J=1,N
    COUSW(J)=0.000
    RSCALE(J)=0.00
    MEANZ(J)=0.00
    PPRIME(I,J)=0.00
    ZPRIME(I,J)=0.00
350 SUM(J)=0.000
    DO 352 J=1,N
    DO 351 K=1,N
    IF(ABS(ZW(J,K)).LE.2.0) GO TO 354
    GO TO 351
354 SUM(J)=SUM(J)+ZW(J,K)
    COUSW(J)=COUSW(J)+1.0
351 CONTINUE
352 CONTINUE
    DO 360 J=1,N
    IF(COUSW(J).LT.1.0) GO TO 360
    MEANZ(J)=SUM(J)/COUSW(J)
360 CONTINUE
    XMINZ=10.0
    DO 365 K=1,N
    IF(XMINZ.GT.MEANZ(K)) XMINZ=MEANZ(K)
365 CONTINUE
    DO 375 J=1,N
    RSCALE(J)=MEANZ(J)-XMINZ
375 CONTINUE
    DO 401 J=1,N
    JK=J+1
    IF(JK.GT.N) GO TO 401
    DO 400 K=JK,N
    ZPRIME(J,K)=RSCALE(K)-RSCALE(J)
400 CONTINUE
401 CONTINUE
    DO 403 J=1,N
    JK=J+1
```

FIGURE C2. (Cont'd.)

```
      IF(JR.GT.N) GO TO 409
      DO 402 K=JR,N
      PRIME(J,K)=PROPAB(PRIME(J,K))
  402 CONTINUE
  409 CONTINUE
      DO 410 J=1,N
      JR=J+1
      IF(JR.GT.N) GO TO 410
      DO 409 K=JR,N
      IF(ABS(ZPRIME(J,K)).GT.2.00) GO TO 409
      XZ=SQRT(PRIME(J,K))
      IF(XZ.GT.1.0) XZ=0.9999
      IF(XZ.LT.0.0) XZ=0.0001
C     USE 'ASIN' ON CPC MACHINES AND 'ARSIN' ON IBM MACHINES HERE
      THETAP(J,K)=57.295779*ARSIN(XZ)
  409 CONTINUE
  410 CONTINUE
      DO 421 J=1,N
      JR=J+1
      IF(JR.GT.N) GO TO 421
      DO 420 K=JR,N
      IF(ABS(ZMIK,J)).GT.2.00) GO TO 420
      XZ=SQRT(PMIK,J))
      IF(XZ.LE.0.0) XZ=0.0001
      IF(XZ.LT.1.0) XZ=0.9999
C     USE 'ASIN' ON CPC MACHINES AND 'ARSIN' ON IBM MACHINES HERE
      THETA(J,K)=57.295779*ARSIN(XZ)
  420 CONTINUE
  421 CONTINUE
      CHI=0.000
      DO 431 J=1,N
      JR=J+1
      IF(JR.GT.N) GO TO 431
      DO 430 K=JR,N
      IF (ABS(ZMIK,J)).GT.2.0) GO TO 430
      CHI=CHI+((THETA(J,K)-THETAP(J,K))**2)
  430 CONTINUE
  431 CONTINUE
      R=NREP1
      N=NPER1
      CHISQR=(CHI/R2)-(.5*R*N
      IDF=(N-1)*(N-2)/2
C  OUTPUT FOR PAIR COMPARISON PROGRAM (CASE V/VA ONLY)
      WRITE(6,10001)(TITLE(I),I=1,12)
10001 FORMAT(1H1,20X,23HPAIR COMPARISON SCALING // 21X,12A6//)
      WRITE(6,10010)
10010 FORMAT(1HO,11X,28HPROPORTION MATRIX (OBSERVED) ///5X,40HSTIMULUS A
     1F TOP JUDGED GREATER THAN SIDE )
      IF(ALSCALE.LT.1) GO TO 10015
      WRITE(6,10011)(ESCALE(I),I=1,N)
10011 FORMAT(1HO,14X,16(F7))
      IF(ALSCALE.GE.1) GO TO 10021
10015 CONTINUE
      DO 10020 J=1,N
      WRITE(6,10016)(PMIK(J,I),I=1,N)
10016 FORMAT(1HO,14X,15F7.4)
10020 CONTINUE
      GO TO 10030
10021 CONTINUE
      DO 10025 J=1,N
      WRITE(6,10022)ESCALE(J),(PMIK(J,I),I=1,N)
```

FIGURE C2. (Cont'd.)

```
10022 FORMAT(1HO,8X,I7,2X,15F7.4)
10025 CONTINUE
10030 CONTINUE
      WRITE(6,100011
      WRITE(6,100401
10040 FORMAT(1HO,13X,28HZ DEVIATE MATRIX (CASE V/OA) ///58,45HSCALE SEPA
     1RATIONS BETWEEN PAIRS (TOP VS SIDE))
      IF(ASCALE.LT.1) GO TO 10045
      WRITE(6,10011)(SCALE(I),I=1,N)
      DO 10050 J=1,N
      WRITE(6,10022)SCALE(J),(ZM(I,J),I=1,N)
10050 CONTINUE
      GO TO 10063
10045 CONTINUE
      DO 10055 J=1,N
      WRITE(6,10016)(ZM(I,J),I=1,N)
10055 CONTINUE
10063 CONTINUE
      WRITE(6,10061)(MEANZ(I),I=1,N)
10061 FORMAT(1HO//58,21HMEAN Z SCORE PER COL. // 18X,15F7.4)
      WRITE(6,10062)(SCALE(I),I=1,N)
10062 FORMAT(1HO//5X,47HSTIMULUS SCALE WITH ZERO ASSUMED = LOWEST VALUE
     1//18X,15F7.4)
      WRITE(6,10063)CHISQR,IDF
10063 FORMAT(1HO///10X,51HTEST FOR INTERNAL CONSISTENCY ASSUMING CASE V
     1OR VA ///15X,12HCHI SQUARE = ,F10.4,4X,4HWITH,I5,4X,18HDEGREES OF
     2FREEDOM // 70X,41H**CHECK WITH SIGNIFICANCE LEVEL IN TABLES )
C CASE III
      IF(CASE3.LE.1) GO TO 9000
      DO 500 J=1,N
  500 VARZ(J,J)=0.000
      DO 511 J=1,N
      DO 510 K=1,N
      IF(ABS(ZM(J,K)).GT.2.0) GO TO 510
      VARZ(J,J)=VARZ(J,J)+(MEANZ(J)-ZM(J,K))**2
  510 CONTINUE
  511 CONTINUE
      SUMVAR=0.000
      DO 515 J=1,N
  515 SUMVAR=SUMVAR + 1.0/VARZ(J,J)
      XN=N
      C=XN/SUMVAR
      DO 520 J=1,N
  520 SIGMAJ(J)=C/VARZ(J,J)
      DO 530 J=1,N
      DO 529 K=1,N
      ZM(J,K)=ZM(J,K)*SQRT((SIGMAJ(J)**2)+(SIGMAJ(K)**2))
  529 CONTINUE
  530 CONTINUE
      DO 1350 J=1,N
      COUSM(J)=0.000
 1350 SUM(J)=0.000
      DO 1352 J=1,N
      DO 1351 K=1,N
      IF (ABS(ZM(J,K)).LE.2.0) GO TO 1354
      GO TO 1351
 1354 SUM(J)=SUM(J)+ZM(J,K)
      COUSM(J)=COUSM(J)+1.0000
 1351 CONTINUE
 1352 CONTINUE
      DO 1360 J=1,N
```

FIGURE C2. (Cont'd.)

```
      MEANZ3(J)=SUM3(J)/COUSM3(J)
      XMINZ3=10.00
      DO 1365 K=1,N
      IF(XMINZ3.GT.MEANZ3(K)) XMINZ3=MEANZ3(K)
 1365 CONTINUE
      DO 1375 J=1,N
 1375 RSCALE(J)=MEANZ3(J)-XMINZ3
      DO 1401 J=1,N
      JK=J+1
      IF(JK.GT.N) GO TO 1401
      DO 1400 K=JK,N
      ZSPRIM(J,K)=(RSCALE(K)-RSCALE(J))/(SQRT((SIGMA(J,J)+SIGMA(K,K)
     1)-2.*SIGMA(J,K)))**2)
 1400 CONTINUE
 1401 CONTINUE
      DO 1403 J=1,N
      JK=J+1
      IF(JK.GT.N) GO TO 1403
      DO 1402 K=JK,N
      PSPRIM(J,K)=PROPAB(ZSPRIM(J,K))
 1402 CONTINUE
 1403 CONTINUE
      DO 1410 J=1,N
      JK=J+1
      IF(JK.GT.N) GO TO 1410
      DO 1409 K=JK,N
      YZ=SQRT(PSPRIM(J,K))
      IF(YZ.LE.0.0) YZ=0.0001
      IF(YZ.GT.1.0) YZ=0.9999
C     USE 'ASIN' ON CDC MACHINES AND 'ARSIN' ON IBM MACHINES HERE
      THETSP(J,K)=57.2957795*ARSIN(YZ)
 1409 CONTINUE
 1410 CONTINUE
      CHI3=0.0000
      DO 1431 J=1,N
      JK=J+1
      IF(JK.GT.N) GO TO 1431
      DO 1430 K=JK,N
      IF (ABS(ZMIK,J)).GT.2.0) GO TO 1430
      CHI3=CHI3+((ETA(J,K)-THETSP(J,K))**2
 1430 CONTINUE
 1431 CONTINUE
      CHISQR=(CHI3/821.0)**8
      ISDF=(IN-1)*(N-4)/2
C  OUTPUT FOR PAIR COMPARISONS PROGRAM (CASE III)
      WRITE(6,10001)
      WRITE(6,10110)
10110 FORMAT(1HO,114,27HZ DEVIATE MATRIX (CASE III) /// 58,45HSCALE SEPA
     1RATIONS BETWEEN PAIRS (TOP VS SIDE))
      IF(ASCALE.LT.1) GO TO 10125
      WRITE(6,10011)(FSCALE(I),I=1,N)
      DO 10120 J=1,N
      WRITE(6,10022)ESCALE(J),(ZM3(I,J),I=1,N)
10120 CONTINUE
      GO TO 10130
10125 CONTINUE
      DO 10126 J=1,N
      WRITE(6,10016)(ZM3(I,J),I=1,N)
10126 CONTINUE
10130 CONTINUE
      WRITE(6,10061)(MEANZ3(I),I=1,N)
```

FIGURE C2. (Cont'd.)

```
      WRITE(6,10062)(PSCALE(I),I=1,N)
      WRITE(6,10040)CHISQR,IDF
10040 FORMAT(1HO///10X,47HTEST FOR INTERNAL CONSISTENCY ASSUMING CASE II
     1I  /// 15X,12HCHI SQUARE = ,F10.4,4X,4HWITH,I5,4X,18HDEGREES OF FR
     1EEDOM ///10X,41HPCHECK WITH SIGNIFICANCE LEVEL IN TABLES  )
C ZERO POINT LOCATION
 9000 CONTINUE
      DO 2001 I=1,N
 2001 PROBEC(I)=0.000
      REWIND 20
      DO 2050 I=1,N
      COUDEC(I)=0
 2030 DEC(I)=0
      DO 2100 I=1,NPER1
      READ(20,INPUT)(VAR(I,J),J=1,NVAR)
      DO 2120 K=1,N
      EXX=DEC(K)
      DEC(K)=EXX+VAR(I,K)
 2120 CONTINUE
      DO 2150 J=1,N
      IF(DEC(J).GT.1) GO TO 2150
      K=DEC(J)
      PROBEC(J)=PROBIF(J) + 0
      COUDEC(J)=COUDIF(J)+1
 2150 CONTINUE
 2100 CONTINUE
      DO 2200 J=1,N
      C=COUDEC(J)
      IF(C.EQ.0.0) GO TO 2251
      PROBEC(J)=PROBIF(J)/C
 2200 CONTINUE
      DO 2250 J=1,N
      A(J)=ZSCORE(PROBEC(J))
 2250 CONTINUE
 2251 CONTINUE
 9900 CONTINUE
C  OUTPUT CONTROL FOR LOCATION OF ZERO POINT (IF USED)
      WRITE(6,10201)
10201 FORMAT(1HO,5X,40HSCALE FOR LOCATING MEANINGFUL ZERO POINT )
      IF(SCALE.LT.1) GO TO 10225
      WRITE(6,10210)(PSCALE(I),I=1,N)
10210 FORMAT(1HO,10X,24HASSOCIATED SCALE VALUES //10X,15(F
10225 CONTINUE
      WRITE(6,10226)(A(J),J=1,N)
10226 FORMAT(1HO,15X,14HA(J) SCALE ** //10X,15F7.4)
      WRITE(6,10227)
10227 FORMAT(1HO,40X,73H**  MUST NOW BE RELATED TO SCALE FROM CASE V/VA
     1OR CASE III BY REGRESSION )
19900 CONTINUE
      REWIND 20
      RETURN
      END
$IBFTC SUBS
      FUNCTION ZSCORE(PR)
C FINDS Z SCORES FOR CORRESPONDING PROBABILITIES
      REAL LPZ,LPP
      DIMENSION SPZ(2501),SPP(2501),LPZ(1481),LPP(1481)
      COMMON SPZ,SPP,LPZ,LPP
      P=PR
      SIGN=1.0
   50 CONTINUE
```

FIGURE C2. (Cont'd.)

```
      IF(P.GE..025) GO TO 1000
      DO 100 I=3,250
      IF(P.LT.SPP(I)) GO TO 200
  100 CONTINUE
  200 X=SPP(I)-P
      ZSCORE=SIGN*(SPP(I)+(SPZ(I-1)-SPZ(I))*X/.0001)
      RETURN
 1000 CONTINUE
      IF(P.GE..5000) GO TO 2000
      DO 1100 J=3,481
      IF(P.LT.LPP(J)) GO TO 1200
 1100 CONTINUE
 1200 X=LPP(J)-P
      ZSCORE=SIGN*(LPZ(J)+(LPZ(J-1)-LPZ(J))*X/.0001)
      RETURN
 2000 CONTINUE
      IF(P.EQ..5000) GO TO 5000
      SIGN=+1.0
      P=1.0-P
      GO TO 50
 5000 CONTINUE
      ZSCORE=+0.00000
      RETURN
      END
$IBFTC SUB04
      FUNCTION PROBABIL(X)
C FINDS PROBABILITY FOR CORRESPONDING Z SCORES
      REAL LPZ,LPP
      DIMENSION SPZ(2501),SPP(2501),LPZ(481),LPP(481)
      COMMON SPZ,SPP,LPZ,LPP
      Z=ZX
      IF(Z) 100,101,102
  100 CONTINUE
      SIGN=-1.0
   50 CONTINUE
      Z=ABS(Z)
      IF(Z.LE.1.961681) GO TO 1050
      DO 60 I=3,250
      IF(Z.GT.SPZ(I)) GO TO 80
   60 CONTINUE
   80 X=Z-SPZ(I)
      P=SPP(I)-.0001*X/(SPZ(I-1)-SPZ(I))
      GO TO 4000
 1050 CONTINUE
      DO 1060 J=3,481
      IF(Z.GT.LPZ(J)) GO TO 1080
 1060 CONTINUE
 1080 X=Z-LPZ(J)
      P=LPP(J)-.0001*X/(LPZ(J-1)-LPZ(J))
      GO TO 4000
  102 CONTINUE
      SIGN=+1.0
      GO TO 50
  101 CONTINUE
      PROBAB=+.50000
      RETURN
 4000 CONTINUE
      IF(SIGN.GT.0.0) P=1.-P
      PROBAB=P
      RETURN
      END
```

FIGURE C2. (Cont'd.)

```
$IBFTC SUBOS
      SUBROUTINE SECCAT(INFMT2,NCASE,NREP2,NCATEG,NPER2,MODECD,NVAR2)
C  PROGRAM DIMENSIONS ALLOW ONLY 50 VARIABLES AND 15 CATEGORIES AT
C  PRESENT. THIS MAY BE CHANGED IF DESIRED AND IF MACHINE SIZE WILL ALLOW
      DIMENSION ORDER(100),ESCALE(100),IALPHA(26),INFMT2(60),
     1PROP(50,15),PM(50,15),KOUNT(50),IVAR2(100),ZM(50,15),ZDIF(50,15),
     2MD(50),LC(50),MC(50),AC(50),CASEMD(50),ZPRIMM(50,15),
     3PPRIMM(50,15),SIGZJ(50),MEANZJ(50),SIGJ(50),AJ(50),MEANJ(50),
     4CDR(50),ETITLE(12),AJJ(50)
      DIMENSION CSW(50),CSD(50)
      INTEGER ORDER,ESCALE,DFROM,ASCALE,INFMT2
      REAL MC,MC,LC,MFANL,MEANZJ,MEANJ
      INTEGER XESCAL
      DIMENSION XESCAL(50)
      COMMON /B2/ IALPHA,ETITLE
      COMMON /B3/ ESCALE,PM,KOUNT,ZM,ZDIF,MD,LC
      REWIND 30
      LL=0
      IF=0
      N=NCASE/NREP2
      JK=NCATEG-1
      READ(5,10)IMID,ITOT,ASCALE,(ORDER(I),I=1,NCASE)
   10 FORMAT(5X,12,11,1X,11,1415/2015)
      IF(ASCALE.LT.1) GO TO 30
   20 READ(5,21)(ESCALE(I),I=1,NCASE,NREP2)
   21 FORMAT(10X,1415)
      DO 29 I=1,NCASE,NREP2
      JK=I + 1
      KK=I + NREP2 - 1
      IF(JK.GT.KK) GO TO 29
      DO 28 K=JK,KK
      ESCALE(K)=ESCALE(I)
   28 CONTINUE
   29 CONTINUE
   30 CONTINUE
      DO 41 I=1,NCASE
      DO 40 J=1,NCATEG
      ZM(I,J)=0.00
      ZDIF(I,J)=0.00
      PPRIMM(I,J)=0.00
      ZPRIMM(I,J)=0.00
      SIGZJ(I)=0.00
      MEANZJ(I)=0.00
      SIGJ(I)=0.00
      PROP(I,J)=0.0
      KOUNT(I)=0
      AJ(I)=0.00
      AJJ(I)=0.00
   40 CONTINUE
   41 CONTINUE
      DO 1001 I=1,NPER2
      READ(30,INFMT2)(IVAR2(J),J=1,NVAR2)
      IF(MODECD.LT.1) GO TO 120
      DO 102 J=1,NCASE
      IJ=ORDER(J)
      IABC=IVAR2(IJ)
      DO 50 K=1,NCATEG
      IF(IABC.EQ.IALPHA(K)) GO TO 60
   50 CONTINUE
      KOUNT(J)=KOUNT(J)+1
      GO TO 102
```

FIGURE C2. (Cont'd.)

```
   60 CONTINUE
      PROP(J,K)=PROP(J,K)+1.
  102 CONTINUE
      GO TO 1001
  120 CONTINUE
      DO 122 J=1,NCASP
      JJ=ORDER(J)
      IABC=IVAR2(JJ)
      IF((IABC.LT.1).OR.(IABC.GT.NCATEG)) GO TO 150
      PROP(J,IABC)=PROP(J,IABC)+1.
      GO TO 122
  150 KOUNT(J)=KOUNT(J)+1
  122 CONTINUE
 1001 CONTINUE
      DO 1011 I=1,NCASE
      DO 1010 J=1,NCATEG
      RSR=NPER2-KOUNT(I)
      PM(I,J)=PROP(I,J)/RSR
 1010 CONTINUE
 1011 CONTINUE
 1012 CONTINUE
      IF(IDF.GE.1) GO TO 9000
      DO 1015 I=1,NCASE
      DO 1014 J=2,NCATEG
      JJ=J-1
      PM(I,J)=PM(I,JJ)+PM(I,J)
 1014 CONTINUE
 1015 CONTINUE
 1016 CONTINUE
      IF(NREP2.EQ.1) GO TO 1017
      IF(NREP2.LE.IF) GO TO 9000
 1017 IF=IF + 1
 1018 CONTINUE
      DO 1021 I=IF,NCASE,NREP2
      DO 1020 J=1,NCATEG
      ZM(I,J)=ZSCORE(PM(I,J))
 1020 CONTINUE
 1021 CONTINUE
      DO 1031 I=IF,NCASE,NREP2
      DO 1030 J=2,JX
      JJ=J-1
      IF((ABS(ZM(I,J)).GT.2.33).OR.(ABS(ZM(I,JJ).GT.2.33)) GO TO 1030
      ZDIF(I,J)=ZM(I,J)-ZM(I,JJ)
 1030 CONTINUE
 1031 CONTINUE
      DO 1032 J=1,NCATEG
      MC(J)=0.00
      AC(J)=0.00
      LC(J)=0.00
      MD(J)=0.00
      CD(J)=0.00
      STDZ(J,J)=0.00
      MEANZ(J,J)=0.00
 1032 CONTINUE
      DO 1041 J=2,JX
      DO 1040 I=IF,NCASE,NREP2
      JJ=J-1
      IF((ABS(ZM(I,J)).GT.2.33).OR.(ABS(ZM(I,JJ).GT.2.33)) GO TO 1040
      MD(J)=MD(J) + ZDIF(I,J)
      CD(J)=CD(J)+1.0
 1040 CONTINUE
```

FIGURE C2. (Cont'd.)

```
      IF(CDF(J).LT.1.00) GO TO 1041
      MD(J)=PE(J)/CDF(J)
 1041 CONTINUE
      LC(1)=PE(1)
      DO 1042 J=3,JR
      LC(J)=LC(J-1)+ME(J)
 1042 CONTINUE
      MC(2)=PE(2)/2.
      DO 1043 J=3,JR
      MC(J)=PE(J-1)+MF(J-1)/2. + MD(J)/2.
 1043 CONTINUE
      DO 1045 J=2,JR
      AC(J)=PE(J)-MC(IMID)
 1045 CONTINUE
      DO 1051 I=IF,NCASE,NREP2
      DO 1050 J=1,NCATEG
      IF(PM(I,J).GT..900) GO TO 1060
 1050 CONTINUE
 1060 CONTINUE
      A=PM(I,J)-.500
      CASEMD(I)=LC(J)-(LC(J)-LC(J-1))*A/(PM(I,J)-PM(I,J-1))
 1051 CONTINUE
      DO 1065 I=IF,NCASE,NREP2
      AJ(I)=CASEMD(I)-MC(IMID)
 1065 CONTINUE
      N11=NCASE
      N12=NREP2
      SAJ=0.00
      SSAJ=0.00
      DO 1070 J=IF,NCASE,NREP2
      SAJ=SAJ + AJ(J)
      SSAJ=SSAJ + (AJ(J)**2)
 1070 CONTINUE
      SIGA=(SSAJ-((SAJ*SAJ)/(N11/N12)))/((N11/N12)-1.0)
      DO 1075 I=IF,NCASE,NREP2
      CSV(I)=A.DMAJ(I)/SIGA
 1075 CONTINUE
C  TEST FOR INTERNAL CONSISTENCY
      DO 2011 I=IF,NCASE,NREP2
      DO 2010 J=1,JR
      PPRIMM(I,J)=LC(J)-CASEMD(I)
 2010 CONTINUE
 2011 CONTINUE
      DO 2020 I=IF,NCASE,NREP2
      DO 2019 J=1,JR
      PPRIMM(I,J)=PROPABZ(PRIMM(I,J))
 2019 CONTINUE
 2020 CONTINUE
      XDIF=0.00
      DIF=0.00
      DO 2030 I=IF,NCASE,NREP2
      DO 2029 J=1,JR
      IF (ABS(ZM(I,J)).GT.2.33) GO TO 2029
      XFT=PM(I,J) - PPRIMM(I,J)
      DIF=DIF + ABS(XFT)
      XDIF=XDIF +1.
 2029 CONTINUE
 2030 CONTINUE
      DIF=DIF/XDIF
      CHI=0.00
      DO 2051 I=IF,NCASE,NREP2
```

FIGURE C2. (Cont'd.)

```
      DO 2050 J=1,JM
      YZ=SQRT(YMI(1,J))
      XYZ=SQRT(XPRIMM(1,J))
      IF(YZ.LE.0.0) YZ=0.0001
      IF(YZ.GE.1.0) YZ=0.9999
C     USE 'ASIN' ON CTC MACHINES AND 'ASIN' ON IBM MACHINES HERE
      THETA=ARSIN(YZ)*1457.2957795
      IF(XYZ.LE.0.0) XYZ=0.0001
      IF(XYZ.GE.1.0) XYZ=0.9999
C     USE 'ASIN' ON CTC MACHINES AND 'ASIN' ON IBM MACHINES HERE
      THETAP=ARSIN(XYZ)*1457.2957795
      IF (ABS(ZMI(1,J)).GT.2.99) GO TO 2050
      CHI=CHI+(THETA-THETAP)**2
 2050 CONTINUE
 2051 CONTINUE
      IF(LL.GT.1) GO TO 9005
      NZZ=NPER2-NQUNTII
      CHISQR=CHI*NZZ/NZI.0
      DFREM=(NCATEG-1)*NCASE/NREPZ1-(NCASE/NREPZ1-NCATEG + 2
C  ESTIMATION OF STANDARD DEVIATIONS
 2061 CONTINUE
      DO 2061 I=1P,NCASE,NREPZ
      M=3
      SUP=0.0
      ZR=0.0
      DO 2060 J=2,JM
      IF(ABS(ZMI(I,J)).GT.2.99) GO TO 2060
      M=M+1
      SUP=SUP + (ZMI(I,J)**2)
      ZR=ZR+ZMI(I,J)
 2060 CONTINUE
      RM=M
      IF(((RM.LT.1.01).OR.(SUM.LT..00111) GO TO 2061
      RR1=SUP/RM
      RR2=ZR/RM
      RR3=RR2*RR2
      RR4=RR1 - RR3
      SIGZ(I)=SQRT(RR4)
      MEANZ(I)=RR2
 2061 CONTINUE
      ZL=0.00
      SUML=0.00
      DO 2065 J=2,JM
      SUML=SUML + ELC(J)**2)
      ZL=ZL+ELC(J)
 2065 CONTINUE
      RJM=JM
      RR1=SUML/(RJM-1.0)
      RR2=ZL/(RJM-1.0)
      RR3=RR2*RR2
      RR4=RR1 - RR3
      SIGMAL=SQRT(RR4)
      MEANL=RR2
      DO 2066 J=1P,NCASE,NREPZ
      SIG(J)=SIGMAL/SIGZ(J)
      MEANZ(J)=MEANL-(SIG(J)*MEANZ(J))
      AJJ(J)=MEANZ(J)-MCI(MID)
 2066 CONTINUE
      SAJJ=0.00
      SSAJJ=0.00
      DO 2067 I=1P,NCASE,NREPZ
```

FIGURE C2. (Cont'd.)

```
      SSA(J)=SSA(J) + (A(J,I)**2)
      SA(J)=S(J) + A(J,I)
 2060 CONTINUE
      SIG(J)=(SSA(J)-((SA(J)**2)/(REAL(NREP2)*REAL(NCASE))))/(REAL(NCASE)-1.0)
      DO 2080 I=1,NCASE,NREP2
      CS(I)=4.0*A(J,I)/SSA(J)
 2080 CONTINUE
C  TEST FOR HOMOGENEITY OF VARIANCES (SINGLE REPLICATE CASE)
      WJS=0.00
      SLOG=0.00
      CP=1.00
      W=1.00
      DO 2090 I=1,NCASE,NREP2
      WJS=0.00
      CR=0.00
      SJS=0.00
      DO 2091 J=1,NCATEG
      IF(ABS(ZMI(J,I)).GT.2.33) GO TO 2091
      WJS=WJS + ZMI(J,I)**2
      CR=CR+1.0
      SJS=SJS + ZMI(J,I)
 2091 CONTINUE
      S=(WJS - (SJS**2)/CR)/(CR-1.0)
      W=W*S
      CP=CP + CR - 1.0
      SLOG=SLOG + (CR-1.0)*ALOG(S)
 2090 CONTINUE
      SS=W/CP
      PR=CP*ALOG(SS)
      CHI2=2.302585*(PR-SLOG)
      IF(I.NE.(NCASE/NREP2) + 1
C  OUTPUT CONTROL FOR SCALING FROM LINES SCALES
C  OUTPUT CONTROL FOR SUCCESSIVE CATEGORY PROGRAM SINGLE REPLICATE CASE
 10000 CONTINUE
      WRITE(6,10001)(TITLE(I),I=1,12)
10001 FORMAT(1H1,20X,29HSUCCESSIVE CATEGORIES SCALING // 21X,12A6//)
      IF(I1.LT.1) GO TO 20001
      WRITE(6,10002)IP,NREP2
10002 FORMAT(1HO,11X,40HCUMULATIVE PROPORTIONS MATRIX (OBSERVED) //
     1 20X,I1,1X,2HOF,1X,I1,1X,10HREPLICATES)
10000 CONTINUE
      WRITE(6,10003)(J,J=1,NCATEG)
10003 FORMAT(1HO,45X,21HSUCCESSIVE CATEGORIES // 23X,15I7)
      WRITE(6,10004)
10004 FORMAT(1H ,17X,4HCASE)
      IF(ICALF.LT.1) GO TO 10010
      DO 10006 K=IP,NCASE,NREP2
      WRITE(6,10005)(CALF(I),(PMIN,J),J=1,NCATEG)
10005 FORMAT(1HO,17X,I7,2X,15F7.4)
10006 CONTINUE
      GO TO 10020
10010 CONTINUE
      DO 10016 K=IP,NCASE,NREP2
      WRITE(6,10011)(PMIN,J),J=1,NCATEG)
10011 FORMAT(1HO,24X,15F7.4)
10016 CONTINUE
10020 CONTINUE
      IF(I1.LT.1) GO TO 20009
      WRITE(6,10030)IP,NREP2
10030 FORMAT(1HOF//12X,37HZ DEVIATE MATRIX FOR OBSERVED PROP.) // 20X,
     1I1,1X,2HOF,1X,I1,1X,10HREPLICATES)
```

FIGURE C2. (Cont'd.)

```
11001 CONTINUE
      WRITE(6,10003)(J,J=1,NCATEG)
      WRITE(6,10004)
      IF(ASCALE.LT.1) GO TO 10035
      DO 10031 K=IF,NCASE,NREPZ
      WRITE(6,10005)ESCALE(K),(ZMIN(K,J),J=1,NCATEG)
10031 CONTINUE
      GO TO 10040
10035 CONTINUE
      DO 10037 K=IF,NCASE,NREPZ
      WRITE(6,10011)(ZMIN(K,J),J=1,NCATEG)
10037 CONTINUE
10040 CONTINUE
      WRITE(6,10041)
10041 FORMAT(1HO,20X,42H** * SCORES GT. 2.33 (ABS) WILL BE IGNORED *****)
      WRITE(6,10042)
10042 FORMAT(1HO,11X,'PRIMEAN SEPERATION MATRIX (ORIGINAL PROP.)')
      WRITE(6,10003)(J,J=1,NCATEG)
      WRITE(6,10004)
      IF(ASCALE.LT.1) GO TO 10050
      DO 10047 K=IF,NCASE,NREPZ
      WRITE(6,10005)ESCALE(K),(ZDIFIN(K,J),J=1,NCATEG)
10047 CONTINUE
      GO TO 10055
10050 CONTINUE
      DO 10053 K=IF,NCASE,NREPZ
      WRITE(6,10011)(ZDIFIN(K,J),J=1,NCATEG)
10053 CONTINUE
10055 CONTINUE
      WRITE(6,10060)(MD(J),J=1,NCATEG)
10060 FORMAT(1HO,22HMEAN CATEG. WIDTH (MD),2X,15F7.4)
      WRITE(6,10061)(LC(J),J=2,NCATEG)
10061 FORMAT(1HO,15HLOWER SCALE FOR/1H ,25HUPPER CATEGORY LIMIT (LC),5X,
     1 15F7.4)
      WRITE(6,10062)(MC(J),J=2,NCATEG)
10062 FORMAT(1HO,23HCATEGORY MIDPOINT SCALE ,8X,14F7.4)
      WRITE(6,10063)(AC(J),J=2,NCATEG)
10063 FORMAT(1HO,23HABSOLUTE CATEGORY VALUE/1H ,25HWITH ZERO AT INDIFFER
     1ENCE,6X,14F7.4)
      WRITE(6,10064)
10064 FORMAT(1HO//1H ,11X,10HCASE MEDIAN VALUES ,5X,29HWITH LOCATED ZERO
     1 POINT//10X,4HCASE,10X,6HMEDIAN,10X,5HSCALE,10X,6HSCALE+)
      IF(ASCALE.LT.1) GO TO 10070
      WRITE(6,10065)(ESCALE(J),CASEMD(J),AJ(J),CSV(J),J=IF,NCASE,NREPZ)
10065 FORMAT(1HO,8X,I9,9X,F7.4,8X,F7.4,9X,F7.4)
      IF(ASCALE.GE.1) GO TO 10080
10070 CONTINUE
      WRITE(6,10071)(CASEMD(J),AJ(J),CSV(J),J=IF,NCASE,NREPZ)
10071 FORMAT(1HO,22X,F7.4,8X,F7.4,9X,F7.4)
10080 CONTINUE
      IF(LL.GT.1) GO TO 20010
      WRITE(6,10081)IF,NREPZ
10081 FORMAT(1HO//12X,34HZ DEVIATE MATRIX (EXPECTED VALUES) //20X,II,1X,
     12HUP,1X,II,1X,10HREPLICATES)
11002 CONTINUE
      WRITE(6,10003)(J,J=1,JX)
      WRITE(6,10004)
      IF(ASCALE.LT.1) GO TO 10085
      DO 10084 K=IF,NCASE,NREPZ
      WRITE(6,10005)ESCALE(K),(ZPRIMMIX,J),J=1,JX)
10084 CONTINUE
```

FIGURE C2. (Cont'd.)

```
      GO TO 10090
10085 CONTINUE
      DO 10087 K=IP,NFALE,NREPZ
      WRITE(6,10011)(PPRIMMIK,JJ,J=1,JR)
10087 CONTINUE
10090 CONTINUE
      WRITE(6,10091)
10091 FORMAT(1HO,11X,'EXPECTED PROPORTIONS MATRIX FROM EXPECTED DEVIA
     1TES')
      WRITE(6,10003)(J,J=1,JR)
      WRITE(6,10004)
      IF(SCALE.LE.0) GO TO 10095
      DO 10092 K=IP,NFALE,NREPZ
      WRITE(6,10005)(SCALE(K),(PPRIMMIK,JJ,J=1,JR)
10092 CONTINUE
      GO TO 10109
10095 CONTINUE
      DO 10097 K=IP,NFALE,NREPZ
      WRITE(6,10011)(PPRIMMIK,JJ,J=1,JR)
10097 CONTINUE
10109 CONTINUE
C  TEST OF SIGNIFICANCE
      WRITE(6,10101)
10101 FORMAT(1H0///1H0,'RESULTS OF STATISTICAL TEST FOR SIGNIFICANCE')
      WRITE(6,10102)IFF
10102 FORMAT(1H0,20X,'NUMBER OF DISCREPANCIES BETWEEN PROPORTIONS MATRIX
     1S = ',F7.5/F30.5,'---------- ///')
      WRITE(6,10103)CHISQR,DFROM
10103 FORMAT(1H0,20X,13HCHI SQUARE = ,F10.4,4X,'NUMBER',I5,4X,10HDEGREES O
     1F FREEDOM // FOR,4X,'PROPCHECK WITH SIGNIFICANCE LEVEL IN TABLES I
C  ESTIMATES OF STANDARD DEVIATIONS
      WRITE(6,10110)
10110 FORMAT(1H0///1H0,'REVISED SCALE VALUES USING STANDARD DEVIATIONS
     1/1X,8/'FOR EACH CASE DISTRIBUTION OF RESPONSES (S.D. FOUND BY REG
     2RESSION ON LINEN SCALE) // 11X,'CASE',5X,'CHISIMA',2(1X,6A,'MISIMA
     3',6X,'MEAN (',A1,')',A,8X,'MEAN (',A1,')',A,8X,'SCALE **',7A,'SCALE**')
      IF(SCALE.LT.1) GO TO 10130
      DO 10121 K=IP,NFALE,NREPZ
      WRITE(6,10120) FLLALE(K),SIGZJ(K),SIGJ(K),MEANZJ(K),MEANJ(K),
     1AJJ(K),CS(K)
10120 FORMAT(1HO,9X,I5,6(8X,F7.4))
10121 CONTINUE
      GO TO 10140
10130 CONTINUE
      DO 10132 K=IP,NFALE,NREPZ
      WRITE(6,10131) SIGZJ(K),SIGJ(K),MEANZJ(K),MEANJ(K),AJJ(K),CS(K)
10131 FORMAT(1HO,14X,6(8X,F7.4))
10132 CONTINUE
10140 CONTINUE
      WRITE(6,10141)
10141 FORMAT(1HO,20X,'** WITH MEANINGFULLY LOCATED ZERO POINT AT INDIF
     1FERENCE ')
      WRITE(6,10142)
10142 FORMAT(1HO,20X,'/H** SCALES MARKED WITH * OR ** ARE TRANSFORMED TO
     1 TO COMMON SCALE VALUES   ///////')
      WRITE(6,10150)
10150 FORMAT(1HO,11X,'BARTLETT FOR HOMOGENEITY OF VARIANCES ')
      WRITE(6,10103)CH12,IFROM
      IF(LL.GT.1) GO TO 20020
      GO TO 1016
 9000 CONTINUE
```

FIGURE C2. (Cont'd.)

```
      II=1
      JJ=2
      KK=NREP2
      DO 9002 I=1,NCASE,NREP2
      DO 9001 J=1,NCATEG
      IK=IK+1
      I41=I+NREP2-1
      DO 9003 K=IK,I41
      PM(I,JJ)= PM(I,JJ)+PM(K,J)
      PM(I,JJ)=PM(I,JJ)/84
 9003 CONTINUE
 9001 CONTINUE
 9002 CONTINUE
      GO TO 5558
 9005 CONTINUE
      NJJ=INPFR2/-KOUNT(1))*NREP2
      CHISQR=CHIMS(JJ)21.0
      DF=DM=(NCATEG*MATASET-NCASE-NCATEG+1
      GO TO 2004
C  OUTPUT CONTROL FOR SCALING FROM LINEW SCALES FOR COMBINED CASES
20001 CONTINUE
      WRITE(6,200021
20002 FORMAT(1HO,11X,60HCUMULATIVE PROPORTIONS MATRIX (OBSERVED) FOR ALL
     1 REPLICATES )
      GO TO 11000
20005 CONTINUE
      WRITE(6,200061
20006 FORMAT(1HO//12X,37HZ DEVIATE MATRIX (FOR OBSERVED PROP.))
      GO TO 11001
20010 CONTINUE
      WRITE(6,200111
20011 FORMAT(1HO//12X,34HZ DEVIATE MATRIX (EXPECTED VALUES))
      GO TO 11002
20020 CONTINUE
      WRITE 80
      RETURN
      END
DATA
  99.00000   4.71902   3.94008   3.43161   3.05279
   3.79053   3.23888   3.19665   3.15591   3.12149
   3.09023   3.06181   3.03567   3.01145   2.98868
   2.96774   2.94784   2.92905   2.91124   2.89430
   2.87816   2.86274   2.84796   2.83379   2.82016
   2.80703   2.79438   2.78215   2.77031   2.75888
   2.74778   2.73701   2.72655   2.71638   2.70648
   2.69684   2.68745   2.67829   2.66934   2.66061
   2.65207   2.64372   2.63555   2.62756   2.61973
   2.61205   2.60453   2.59715   2.58991   2.58281
   2.57583   2.56897   2.56224   2.55562   2.54910
   2.54270   2.53640   2.53019   2.52408   2.51807
   2.51214   2.50631   2.50055   2.49488   2.48929
   2.48377   2.47833   2.47296   2.46765   2.46243
   2.45726   2.45216   2.44713   2.44215   2.43724
   2.43238   2.42758   2.42283   2.41814   2.41350
   2.40891   2.40437   2.39989   2.39545   2.39106
   2.38671   2.38240   2.37814   2.37392   2.36975
   2.36562   2.36152   2.35747   2.35345   2.34947
   2.34553   2.34162   2.33775   2.33392   2.33012
   2.32635   2.32261   2.31891   2.31524   2.31160
   2.30798   2.30440   2.30085   2.29733   2.29383
   2.29037   2.28693   2.28352   2.28013   2.27677
```

FIGURE C2. (Cont'd.)

FIGURE C2. (Cont'd.)

.87790	.87422	.87055	.86689	.86325
.85962	.85600	.85239	.84879	.84520
.84162	.83805	.83450	.83095	.82742
.82390	.82038	.81687	.81338	.80990
.80642	.80296	.79950	.79606	.79262
.78919	.78577	.78237	.77897	.77557
.77219	.76882	.76546	.76210	.75875
.75542	.75208	.74876	.74545	.74214
.73885	.73556	.73228	.72900	.72574
.72248	.71923	.71599	.71275	.70952
.70630	.70309	.69988	.69668	.69349
.69031	.68713	.68396	.68080	.67764
.67449	.67135	.66821	.66508	.66196
.65884	.65573	.65262	.64952	.64643
.64335	.64027	.63719	.63412	.63106
.62801	.62496	.62191	.61887	.61584
.61281	.60979	.60678	.60376	.60076
.59776	.59477	.59178	.58879	.58581
.58284	.57987	.57691	.57395	.57100
.56805	.56511	.56217	.55924	.55631
.55338	.55047	.54755	.54464	.54174
.53884	.53594	.53305	.53016	.52728
.52440	.52153	.51866	.51579	.51293
.51007	.50722	.50437	.50153	.49869
.49585	.49302	.49019	.48736	.48454
.48173	.47891	.47610	.47330	.47050
.46770	.46490	.46211	.45933	.45654
.45376	.45099	.44821	.44544	.44268
.43991	.43715	.43440	.43164	.42889
.42615	.42340	.42066	.41793	.41519
.41246	.40974	.40701	.40429	.40157
.39886	.39614	.39343	.39073	.38802
.38532	.38262	.37993	.37723	.37454
.37186	.36917	.36649	.36381	.36113
.35846	.35579	.35312	.35045	.34779
.34513	.34247	.33981	.33716	.33450
.33185	.32921	.32656	.32392	.32128
.31864	.31600	.31337	.31074	.30811
.30548	.30286	.30023	.29761	.29499
.29237	.28976	.28715	.28454	.28193
.27932	.27671	.27411	.27151	.26891
.26631	.26371	.26112	.25853	.25594
.25335	.25076	.24817	.24559	.24301
.24043	.23785	.23527	.23269	.23012
.22754	.22497	.22240	.21983	.21727
.21470	.21214	.20957	.20701	.20445
.20189	.19934	.19678	.19422	.19167
.18912	.18657	.18402	.18147	.17892
.17637	.17383	.17128	.16874	.16620
.16366	.16112	.15858	.15604	.15351
.15097	.14843	.14590	.14337	.14084
.13830	.13577	.13324	.13072	.12819
.12566	.12314	.12061	.11809	.11556
.11304	.11052	.10799	.10547	.10295
.10043	.09791	.09540	.09288	.09036
.08784	.08533	.08281	.08030	.07778
.07527	.07276	.07024	.06773	.06522
.06271	.06020	.05768	.05517	.05266
.05015	.04764	.04513	.04263	.04012
.03761	.03510	.03259	.03008	.02758
.02507	.02256	.02005	.01755	.01504

FIGURE C2. (Cont'd.)

```
    .01253    .01003    .00752    .00501    .00251
    .00030
ABCDEFGHIJKLMNOPQRSTUVWXYZ

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************************************************************************

      DATA DECK WITH PROGRAM CONTROL CARDS PLACED HERE -
      SEE DESCRIPTION OF CONTROL CARDS FOR INSTRUCTIONS ON DECK SET UP

 ****  THIS PROGRAM WILL RUN ON EITHER AN IBM 7094 OR A CDC 6000 SERIES
 ****  COMPUTER. THE USER IS EXPECTED TO MAKE THE NOTED CHANGES AND
 ****  PROVIDE THE REQUIRED MACHINE CONTROL CARDS AS WELL AS THE FILE
 ****  CONTROL INFORMATION NEEDED BY THE SYSTEM HE RUNS ON.  THE PROGRAM
 ****  IS PRESENTED HERE IN THE FORM FOR RUNING ON AN IBM 7094 WHEN
 ****  SUPPLIED WITH THE REQUIRED ACCOUNTING INFORMATION ON THE $ID CARD.

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FIGURE C2. (Cont'd.)

TABLE C1. PROGRAM CONTROL CARDS FOR PAIR COMPARISON ANALYSIS.

Control Card	Card Column	Coding Information Required and Available Options to be Specified
TITLE	1-80	This card contains any titling information that the user may wish to use to identify the printed output for a single problem. It will appear as the heading of each output section, if not used or desired, a blank card must be inserted in the data deck in the required position. One TITLE card is required for each data deck submitted. All characters (except EOF) are legal on this card.
CONTROL		This card contains program control information for selecting various options and also some descriptive information on the data submitted. One CONTROL card is required for each data deck submitted. All entries are made in integer form, right justified in each field.
	1--7	CONTROL
	8, 9	blank
	10	Number of variable format cards used to describe the data submitted for analysis, limit is 5 cards.
	11-19	blank
	20-25	Number of individual cases or persons in sample, limit is 99999.
	26-39	blank
	40-44	Number of variables in data set including any variables for dichotomous judgements, limit 100
	45-52	blank
	53-55	Number of individual pairs in data set including replicates, limit 100
	56	Number of replicates, limit 5 (may be changed in program)
	57-80	blank

TABLE C1. (Cont'd.)

FORMAT	1-72	Starting in column 1, punch a normal FORTRAN IV statement including enclosing parentheses but omitting the word "FORMAT" -- all variables are to be formated and coded in an integer form.
	73-80	blank
PAIR	1--4	PAIR
	5	blank
	6	1 - assume Case V or Va scaling* 0 - does not calculate Case V scaling
	7	1 - assume Case III scaling* 0 - does not calculate Case III scaling * may assume both cases, in which event the results for Case V will be printed first followed by Case III with both identified as to which case assumptions apply
	8	1 - a related scale is included in the data set, it is assumed to be an interval scale and will be used in the printed output 0 - a related scale is not included nor is there a RSCD control card in the control cards submitted
	9	blank
	10,11	Index of variable that represents the first pair combination when placed in assending order of pairs by the following scheme: first pair in analysis = pair 1 vs 2** second pair = pair 1 vs 3 third pair = pair 1 vs 4 fourth pair = pair 1 vs 5 . . . . n(n - 1)/2 pair = pair n - 1 vs n where n = number of stimuli

TABLE C1. (Cont'd.)

** stimulus number when ordered according to some attribute or when assigned by any other technique for identification purposes only

Note: If more than one replicate is present, the assumed order of pairs is the second replicate of the first pair comes next in order after the n(n - 1)/2 pair of last pair in the first replicate. The same sequence continues with additional replicates

12	blank
13	0 or blank if pair is forward scored (i.e. 1 vs 2)+ 1 if reverse scored (i.e. 2 vs 1)+

+ this means that data may be coded directly and the ordering of the individual pairs entered into the program rather than revising the raw data for input.

14	blank
15,16	Index of the second pair (pair 1 vs 3 or 3 vs 1)
17	blank
18	0 or blank if pair is forward scored 1 if reverse scored
19	blank
20,21	Index of the third pair (pair 1 vs 4 or 4 vs 1)
22	blank
23	0 or blank if pair is forward scored 1 if reverse scored
24	blank
*****	Continue sequence in intervals of 5 card columns until all pairs of all replicates are indexed and scoring direction is indicated for all pairs -- if more than one control card is required use only card columns 10-69 in intervals of 5. Information coded past column 69 will not be entered from any PAIR card including the first in a sequence.

TABLE C1. (Cont'd.)

RSCD	1--4	RSCD
	5	blank
	6-10	Related scale value (if used) for the first stimulus which will be used in the output listing to identify the resulting scales. The actual value of the stimulus or any identifying code may be used including a sequential numbering system for the stimulus if no related scale is available for use.
	11-15	Related scale value for the second stimulus
	*****	Continue sequence in intervals of 5 card columns for each stimulus, do not repeat for replicates in the list of stimuli. Limited to one 80 column card for RSCD.
DICHOT	1--6	DICHOT (used for absolute scaling based upon dichotomous judgements of the individual stimuli)
	7-10	blank
	11,12	Index of variable for judgement on first stimulus, index measured or counted from the end of the list of variables used for judgements on pairs
	13,14	Index of variable for judgement on second stimulus
	15,16	Index of variable for judgement on third stimulus
	*****	Continue sequence in intervals of 2 card columns for each stimulus index

Note: No provision is presently made for replicates of the dichotomous judgements for absolute scaling in this program

General Note: All judgement variables are coded as either a 1 or 2 in the data deck for pairs with:

1 = first stimulus of pair chosen°
2 = second stimulus of pair chosen°

° the coding of the order of stimuli will adjust for the correct ordering, this coding is for the order the stimuli are presented to the subjects

TABLE C1. (Cont'd.)

All judgement variables are coded as either a 0 or 1 in the data deck for absolute scaling with:

0 = dislike
1 = like

CONTINUE	1, 2	Punch as '11' if there is another data deck to be processed as a part of this problem submission
		Punch as '99' if there is no further problem or data deck for this submission

TABLE C2. PROGRAM CONTROL CARDS FOR SUCCESSIVE CATEGORIES ANALYSIS.

Control Card	Card Column	Coding Information Required and Available Options to be Specified
TITLE	1-80	Same as for Pair Comparison analysis, see Table C1.
CONTROL		This card contains program control information for selecting various options and also some descriptive information on the data submitted. One CONTROL card is required for each data deck submitted. All entries are made in integer form, right justified in each field.
	1--7	CONTROL
	8-14	blank
	15	Number of variable format cards used to describe the data submitted for analysis, limit 5 cards
	16-29	blank
	30-35	Number of individual cases or persons in sample, limit is 99999
	36-45	blank
	46-50	Number of variables in data set, limit 100
	51-57	blank
	58-60	Number of cases presented for rating, including replicates, limit 100
	61	Number of replicates, limit 5
	62,63	blank
	64,65	Number of categories used for rating responses or judgements, limit 15
	66	Data mode -- indicates the mode that the data is recorded in on the data cards submitted* 0 - integer variable 1 - alpha code * - default option is numeric mode
	67-80	blank

TABLE C2. (Cont'd.)

FORMAT	1-72	Same as for Pair Comparison analysis, see Table C1.
	73-80	blank
ORDER	1--5	ORDER
	6, 7	Index of the category with a zero value or assumed to represent indifference, must be puncher. If no zero case exists then punch 1 in column 7.
	8	Punch 1 if only total scale is desired in those cases where more than one replicate exists. If left blank the output will include separate analysis of each replicate and the total case.
	9	blank
	10	1 - a related scale is included in the data, it is assumed to be an interval scale and will be used in the printed output 0 - a related scale is not included nor is there an ASCALE control card in the control cards submitted
	11-15	Inde- of variable or stimulus to be placed first or related to the first 'related scale position'
	16-20	Index of second replicate of first variable or stimulus if replicates exist, (or index of variable or stimulus to be placed second or related to the second 'related scale position' if number of replicates is one)
	21-25	Index of third replicate of first variable or stimulus if replicates exist, or if only two replicates exist then index of variable or stimulus to be placed second or related to the second 'related scale position' (or index of variable or stimulus to be placed third or related to the third 'related scale position' if the number of replicates is one)
	26-30	Index of fourth replicate of first variable or stimulus, etc., use card columns 11-80 in 5 column intervals until all variables needed in the analysis have been specified. If a second card is needed for continuation then begin in card column 1-5 and continue

TABLE C2. (Cont'd.)

ASCALE	1--6	ASCALE
	7-10	blank
	11-15	Scale value for first associated variable in the analysis, (see RSCD for Pair Comparison analysis in Table C1.)
	16-20	Scale value for second associated variable in the analysis
	*****	Continue sequence in intervals of 5 card columns for each stimulus, do not repeat for replicates in the list of stimuli. Limited to one 80 column card for ASCALE
CONTINUE	1, 2	Same as for Pair Comparison analysis, see Table C1.

TABLE C3. DATA DECK ORGANIZATION FOR PROBLEM SUBMISSION.*

Control Card	
$JOB	for running on IBM 7094 under moniter
$ID	with required accounting information, see requirements of computer center being used
***	program deck, user may modify sections to his own needs
TITLE	
CONTROL	
FORMAT	
***	data deck, for either Pair Comparison or Successive Categories analysis

PAIR	ORDER
RSCD(if used)	ASCALE(if used)
DICHOT	CONTINUE+
CONTINUE+	

+ Note: CONTINUE cards must follow each data deck submitted, problem types may be mixed if properly submitted with the needed control cards. This card must also follow the last data deck submitted.

EOF	End of File

Note: If more than one problem is run at the same time then all control cards from TITLE to CONTINUE must be repeated for each data deck or problem

* Problem set-up as for an IBM 7094, only the machine control cards change from machine to machine, i.e. $JOB and $ID would change for use on another computer.

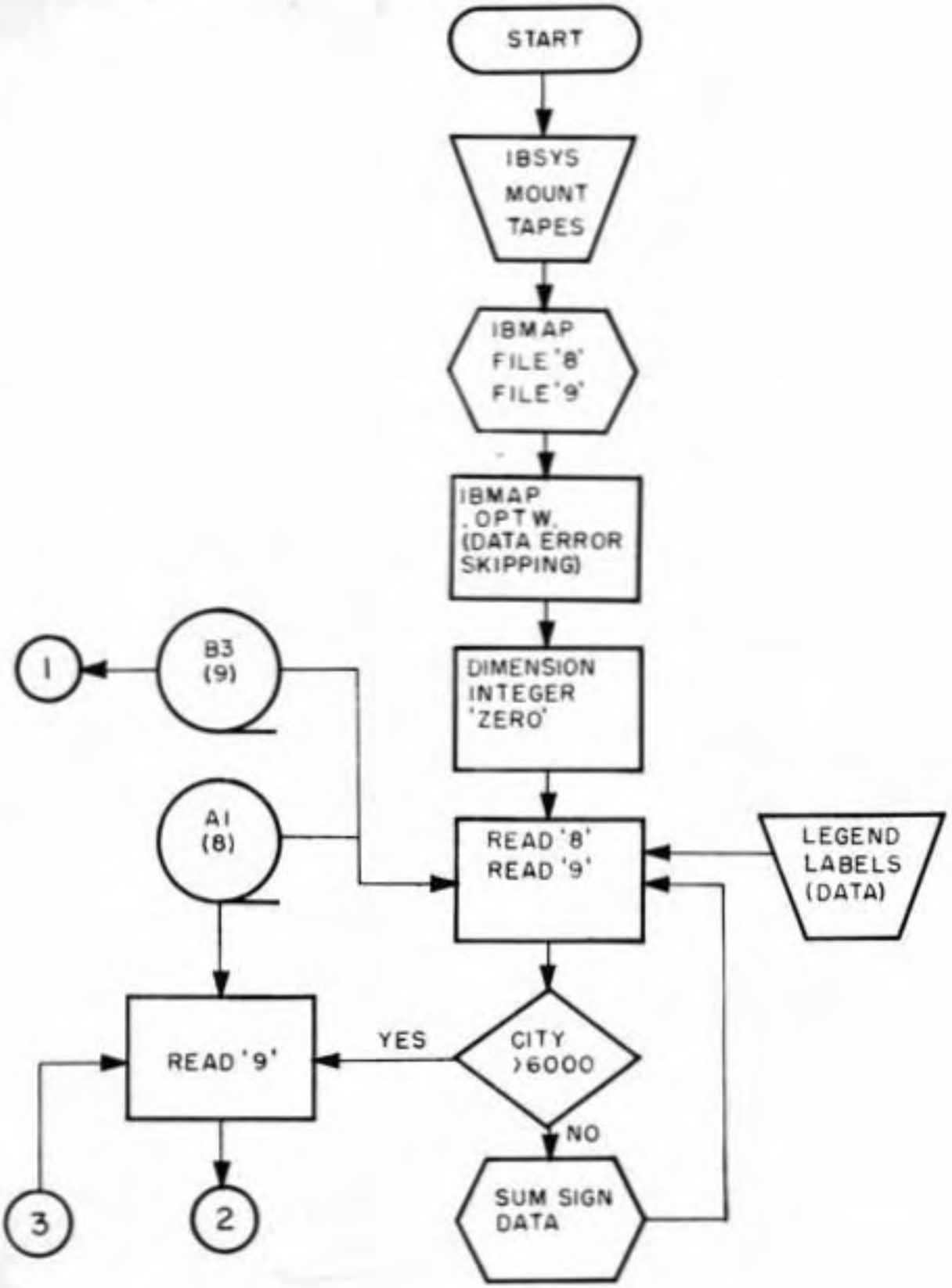

FIGURE C3. SYSTEM FLOW CHARTS FOR I. S. H. C. INVENTORY SUMMARY.

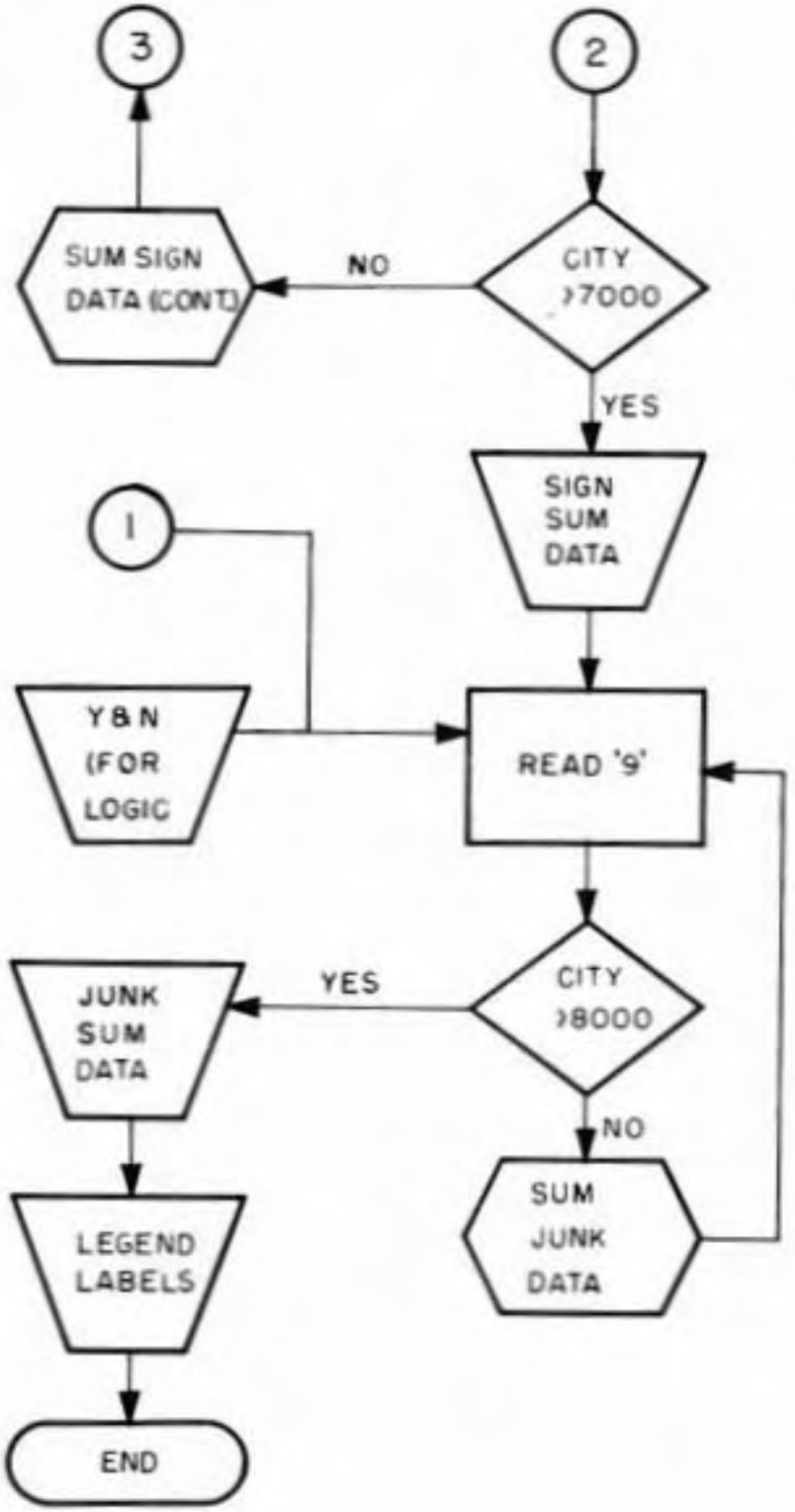

FIGURE C3. (Cont'd.)

TABLE C4. INDIANA STATE HIGHWAY COMMISSION BILLBOARD INVENTORY CODING.*

Card Column	Code	Code Definition
1	S	card type identification - sign inventory
2	U	U. S. Numbered Route
	I	Interstate Route
	S	State Route
	C	County Route
3-5	031+	Route Identification number - 3 digit
6	A	Alternate Route
	N,S,E,W,	Route Designation
	0	if no other code is used must punch 0
7-9	091+	County Code designation - 3 digit
10-13	0121+	City Code designation - 4 digit
14	N,S,E,W,	direction of travel
15-17	053+	road section number - 3 digit
18-20	072+	sign number (not number of signs)
21-24	0100+	road mileage from beginning of section and measured in units of 0.01 miles (eg. sample is coded as 1.00)
25	1	Interstate Route (free)
	2	Interstate Route (toll)
	3	Interstate travelled way (free)
	4	Interstate travelled way (toll)
	5	Other FAP Routes (free)
	6	Other FAP Routes (toll)
26-29	0094+	ADT coded in 100 vehicles per day
30	1	Industerial - zoned
	2	Industerial - unzoned
	3	Commercial - zoned
	4	Commercial - unzoned
	5	Other Activities
	6	on ROW
31-33	050+	estimated distance from ROW - in feet

TABLE C4. (cont'd.)

34	L,R	direction from highway in terms of direction of travel, left or right
35	Y,N	are signs illuminated, yes or no
36-37	24+	horizontal size of sign - feet
38-39	08+	vertical size of sign - feet
40-41	15+	height (over all) of sign - feet
42	S	shape of sign - square
	R	- rectangular
	C	- circular
	T	- triangular
	E	- elliptical
	Ø	- other
43	W	sign material - wood
	M	- metal
	C	- combination
	P	- painted on building
	Ø	- other
44	G	condition of sign - good
	F	- fair
	P	- poor
	A	- abandoned
	C	- under construction
45-56		Owner of sign
57-80		sign legend (if column 57 has a 2 punch, this sign is part of a structure with more than one sign on it)

NOTES: * From "Instruction Manual for Coding and Summarizing Sign and Junkyard Inventory Data," U. S. Department of Commerce, Bureau of Public Roads, Washington, D. C., 1966.

† numbers indicated are samples only, any number up to the limit in digit from card columns left here is allowable

TABLE C5. INDIANA STATE HIGHWAY COMMISSION JUNKYARD INVENTORY CODING.

Card Column	Code	Code Definition
1	J	card type identification - junkyard inventory
2-34		as per Billboard Inventory, Table .
35-38	0115†	estimated size of junkyard in units of 0.01 acres (eg. sample is coded as 1.15)
39-42	1500†	junkyard visibility - approaching (measured in feet)
43-46	2500†	junkyard visibility - leaving (measured in feet)
47	1	auto graveyard
	2	scrap metal
	3	scrap or used building materials
	4	refuse, garbage or trash dump
	5	sanitary fills
	6	other
48	Y,N	screening feasibility, yes or no
49-80		remarks

NOTES: * see Table C4

† see Table C4